

USER'S MANUAL (Detailed Volume)

CC-Link/LT: Power Adapter • Dedicated Power Supply

Covered models

- CL1PAD1
- CL1PSU-2A

CC-Link/LT

Foreword

- This manual contains text, diagrams and explanations which will guide the reader in the correct installation and operation of the CL1PAD1 (Power Adapter for CC-Link/LT) or the CL1PSU-2A (Dedicated Power Supply for CC-Link/LT). It should be read and understood before attempting to install or use the unit.
- If in doubt at any stage of the CL1PAD1 (Power Adapter for CC-Link/LT) or the CL1PSU-2A (Dedicated Power Supply for CC-Link/LT) installation of always consult a professional electrical engineer who is qualified and trained to the local and national standards that applies to the installation site.
- If in doubt about the operation or use of the CL1PAD1 (Power Adapter for CC-Link/LT) or the CL1PSU-2A (Dedicated Power Supply for CC-Link/LT) please consult the nearest Mitsubishi Electric distributor.
- This manual is subject to change without notice.

CC-Link/LT: Power Adapter • Dedicated Power Supply

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Manual number : JY997D06601

Manual revision : F

Date : December 2010

This manual confers no industrial property rights or any rights of any other kind, nor does it confer any patent licenses. Mitsubishi Electric Corporation cannot be held responsible for any problems involving industrial property rights which may occur as a result of using the contents noted in this manual.

Guidelines for the Safety of the User and Protection of the CL1PAD1 and CL1PSU-2A

This manual provides information for the use of the CL1PAD1 and CL1PSU-2A. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows;

- a) Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual should be of a competent nature, trained and qualified to the local and national standards required to fulfill that role. These engineers should be fully aware of all aspects of safety with regards to automated equipment.
- b) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards required to fulfill that job. These engineers should also be trained in the use and maintenance of the completed product. This includes being completely familiar with all associated documentation for the said product. All maintenance should be carried out in accordance with established safety practices.
- c) All operators of the completed equipment (see Note) should be trained to use this product in a safe manner in compliance to established safety practices. The operators should also be familiar with documentation which is associated with the operation of the completed equipment.

Note : The term 'completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual.

Notes on the Symbols Used in this Manual

At various times throughout this manual certain symbols will be used to highlight points of information which are intended to ensure the users personal safety and protect the integrity of equipment. Whenever any of the following symbols are encountered its associated note must be read and understood. Each of the symbols used will now be listed with a brief description of its meaning.

Hardware Warnings



- 1) Indicates that the identified danger **WILL** cause physical and property damage.



- 2) Indicates that the identified danger could **POSSIBLY** cause physical and property damage.



- 3) Indicates a point of further interest or further explanation.

Software Warnings



- 4) Indicates special care must be taken when using this element of software.



- 5) Indicates a special point which the user of the associate software element should be aware of.



- 6) Indicates a point of interest or further explanation.

- Under no circumstances will Mitsubishi Electric be liable responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- Please contact a Mitsubishi Electric distributor for more information concerning applications in life critical situations or high reliability.

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1. Before Use

1.1 Foreword

This manual explains the specifications and handling of the Power Adapter (CL1PAD1) and the Dedicated Power Supply (CL1PSU-2A) for CC-Link/LT to guide the reader in the correct operation of the modules.

Please make sure to read and understand this manual fully before attempting to use the modules.

For the specifications and handling of a master station or remote station, refer to the respective manual.

Please always forward this manual to the end user.

1.2 Generic and abbreviated expressions

The table below shows the generic and abbreviated expressions used in this manual.

Expression	Description
Power adapter	CL1PAD1 (DC power supply, 5A/24V DC output type)
Dedicated power supply	CL1PSU-2A (AC power supply, 2A/24V DC output type)
Master station	A station that controls data link system
Remote I/O station	A remote station for bit information only (for external device I/O)
Remote station	Generic name for remote I/O station and remote device station. Controlled by the master station.
Remote device station	Remote station that handle bit unit and word unit data only.

1.3 Associated manuals

This manual

The contents of the two User's manuals below are included in this manual.

Manual name	Manual No. (Model code)	Description	Included/not included with product
CC-Link/LT: Power Adapter · Dedicated Power Supply USER'S MANUAL (Detailed Volume)	JY997D06601 (09R712)	This manual contains explanations for the specifications, installation, power supply wiring, and cautions on construction, etc. of the power adapter CL1PAD1 and dedicated power supply CL1PSU-2A.	Not included

User's manual

Manual name	Manual No.	Description	Included/not included with product
CL1PAD1 Power Adapter Model User's Manual	JY997D04601	This manual contains explanations for the specifications, installation, etc. of the power adapter CL1PAD1.	Included
CL1PSU-2A CC-Link/LT Dedicated Power Supply User's Manual	JY997D09801	This manual contains explanations for the specifications, installation, etc. of the dedicated power supply CL1PSU-2A.	Included

- For obtaining the manual not included with the product, please consult the Mitsubishi Electric sales site where the product is purchased.
- For related equipment such as a master station or remote station, refer to the documents included with the product or other relevant documents.

1.4 For safe use

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

1.5 Note Concerning the CE Marking

The CE marking does not guarantee that an entire mechanical module produced in accordance with the contents of this note will comply with the following standards. Compliance to EMC directive and LVD directive of the entire mechanical module should be checked by the user / manufacturer. For more details please contact the local Mitsubishi Electric sales site.

Attention

- This product is designed for use in industrial applications.

Note

- Manufactured by:
Mitsubishi Electric Corporation
2-7-3 Marunouchi, Chiyoda-ku, Tokyo, 100-8310 Japan
- Manufactured at:
Mitsubishi Electric Corporation Himeji Works
840 Chiyoda-machi, Himeji, Hyogo, 670-8677 Japan
- Authorized Representative in the European Community:
Mitsubishi Electric Europe B.V.
Gothaer Str. 8, 40880 Ratingen, Germany

EMC

This products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Electromagnetic Compatibility (2004/108/EC) when used as directed by the appropriate documentation.

Refer to the manual or related material of each product for details concerning products not included below.

Type : Programmable Controller (Open Type Equipment)

Models : CL1PAD1 manufactured from November 1st, 2002 to April 30th, 2006 and
CL1PSU-2A manufactured from April 1st, 2004 to April 30th, 2006 are compliant with EN61000-6-4 and EN61131-2:1994+A11:1996+A12:2000
CL1PAD1 and CL1PSU-2A manufactured after May 1st, 2006 are compliant with EN61131-2:2007

Standard		Remark
EN61000-6-4:2001	Electromagnetic compatibility - Generic emission standard Industrial environment	Compliance with all relevant aspects of the standard. (Radiated Emissions and Mains Terminal Voltage Emissions)
EN61131-2:1994 /A11:1996 /A12:2000	Programmable controllers - Equipment requirements and tests	Compliance with all relevant aspects of the standard. (RF Immunity, Fast Transients, ESD and Damped oscillatory wave)
EN61131-2:2007	Programmable controllers - Equipment requirements and tests	Compliance with all relevant aspects of the standard. (Radiated Emissions, Conducted Emissions, Radiated electromagnetic field, Fast transient burst, Electrostatic discharge, High-energy surge, Voltage drops and interruptions, Conducted RF and Power frequency magnetic field)

LVD

The following products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Low Voltage (2006/95/EC) when used as directed by the appropriate documentation.

Refer to the manual or related material of each product for details concerning products not included below.

Type : Programmable Controller (Open Type Equipment)

Models : CL1PSU-2A manufactured from April 1st, 2004 to April 30th, 2006 are compliant with EN61131-2:1994+A11:1996+A12:2000

CL1PSU-2A manufactured after May 1st, 2006 are compliant with EN61131-2:2007

Standard		Remark
EN61131-2:1994 /A11:1996 /A12:2000	Programmable controllers - Equipment requirements and tests	The equipment has been assessed as a component for fitting in a suitable enclosure which meets the requirements of EN61131-2:1994+A11:1996+A12:2000
EN61131-2:2007	Programmable controllers - Equipment requirements and tests	The equipment has been assessed as a component for fitting in a suitable enclosure which meets the requirements of EN61131-2:2007

Notes for compliance to EMC LVD directive

- It is necessary to install the CL1 series module in a shielded metal control panel. For more details please contact the local Mitsubishi Electric sales site.
- Use the CC-Link/LT module in Zone A^{*1} as defined in EN61131-2.
The terminal and the wiring for the following table can be used in zone B^{*1}.

Classification	Model	Terminal that can be used in zone B	Rated load voltage
Relay output ^{*2}	CL1Y4-R1B1 CL1Y4-R1B2	Terminal to connect output signals and load power supply.	240V AC or less ^{*3} 30V DC or less
DC input/ Relay output ^{*2}	CL1XY4-DR1B2 CL1XY8-DR1B2	Terminal to connect output signals and load power supply.	240V AC or less ^{*3} 30V DC or less
CC-Link/LT Dedicated Power Supply	CL1PSU-2A	Terminal block to connect power supply.	100/120/200/230/ 240V AC

*1 Zone defined in EN61131-2

Separation defined in EN61131-2 for EMC LVD regulation decided depending on condition in industrial setting.

Zone C = Factory mains which is isolated from public mains by dedicated transformers.

Zone B = Dedicated power distribution which is protected by secondary surge protection. (300V or less in the rated voltage is assumed.)

Zone A = Local power distribution which is isolated from dedicated power distribution by AC/DC converters, isolation transformers, etc. (120V or less in the rated voltage is assumed.)

*2 Terminal block connection type.

*3 250V AC or less when the unit does not comply with UL or cUL standards.

- When the following models use the CC-Link/LT power adapter model (CL1PAD1), a power line connecting to the external power supply terminal of the CL1PAD1 must be 30m (98'5") or less.

Classification	Model
Analog-Digital Converter ^{*4}	CL2AD4-B
Digital-Analog Converter ^{*4}	CL2DA2-B

*4 Terminal block connection type.

1.6 Trademarks and registered trademarks

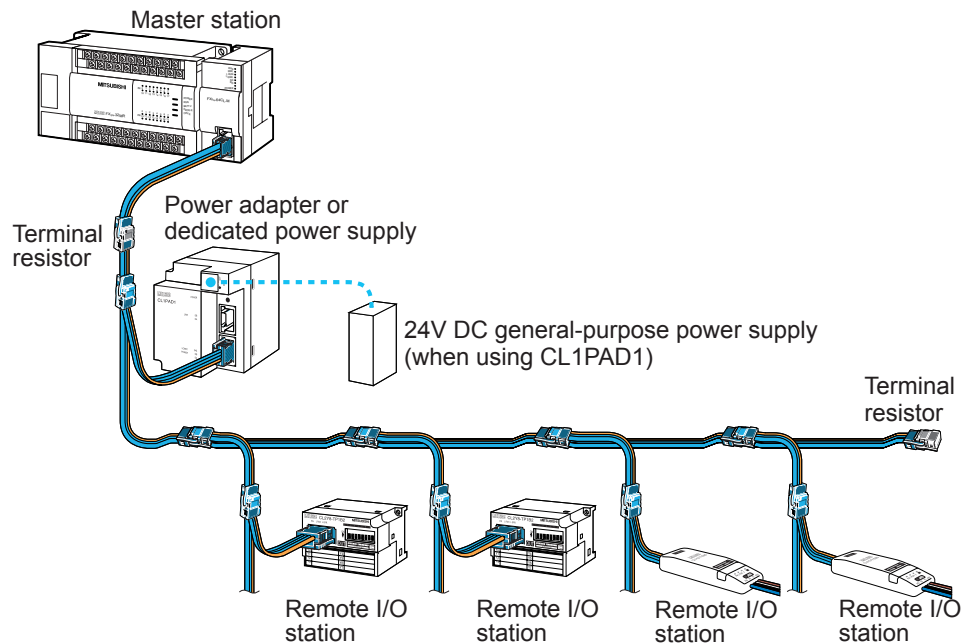
Each of the company names and product names mentioned in this manual is a trademark or registered trademark of each company.

MEMO

2. Introduction (common items)

2.1 Outline of Product

The CL1PAD1 power adapter and the CL1PSU-2A dedicated power supply are connected to the CC-Link/LT system and supply stable 24V DC power.



- Use the connection cables and connectors for CC-Link/LT when connecting a master station, power adapter/dedicated power supply, and remote station.
- When the output current of the power adapter or dedicated power supply is less than the total current consumption of all the stations in the CC-Link/LT system or when voltage drop is large due to a long communication distance, two or more power adapters or dedicated power supply units can be used.
In such a case, a power adapter and a dedicated power supply can be used concurrently.
- Detailed information about connection cables and connectors for CC-Link/LT and terminal resistor can be found on the CC-Link Partner Association's site at <http://www.cc-link.org/>.

2.2 Selection of Power Adapter and Dedicated Power Supply

The input voltage and output current differs in a power adapter and a dedicated power supply. Select products giving consideration to the power supply voltage to the power adapter or a dedicated power supply and the total current consumption of each module in the CC-Link/LT system.


The major specifications of a power adapter and dedicated power supply are shown in the table below.

Item	Specification	
	Power adapter (CL1PAD1)	Dedicated power supply (CL1PSU-2A)
Power supply voltage	24V DC (Max. 28.8V DC)	100,120,200,230,and 240V AC (50/60Hz) (Voltage allowable range: 85V to 264V AC)
Output voltage	24V DC (Max. 28.8V DC)	24V DC +10%/-5%
Output current	Max. 5A (Not exceeding the rated output current of external DC power unit)	0.01A to 2A Derating occurs according to the ambient temperature and power voltage.
	Construct the system properly so that the total current consumption of each module does not exceed the output current of the power adapter or dedicated power supply (except the period immediately after the power is turned on).	

- When using a power adapter, a DC power unit (general-purpose power supply) is required.
- In the following cases, use two or more power adapters or dedicated power supply units to divide the power supplied to the CC-Link/LT system.
 - If the total current consumption of each module exceeds the output current of the power adapter or dedicated power supply
 - If the total current at start-up of each module exceeds the maximum output current (2.2 A) when using a dedicated power supply
 - If the voltage drop is large and exceeds 3.6V
 - If the minimum operating voltage (20.4V DC) for a master station or remote station is not assured due to the voltage drop

3. Outline (CL1PAD1)

Design precautions

 DANGER

- If a failure occurs in the station the output may switch to the ON or OFF status. For output signals which can lead to a severe accident, install a circuit monitoring device outside the module.

 CAUTION

- Do not bind the control cable or the connection cable together with the main circuit and power cable. Keep such cables far from the main circuit and power cable. Assure a distance of 100mm (3.94") or more, otherwise malfunction may occur due to excessive noise.
- Use the power adapter or the dedicated power supply without applying any force on the connector of the CC-Link/LT interface and the connection cable. Otherwise, such cables may break or fail.

Transportation and maintenance precautions

 CAUTION

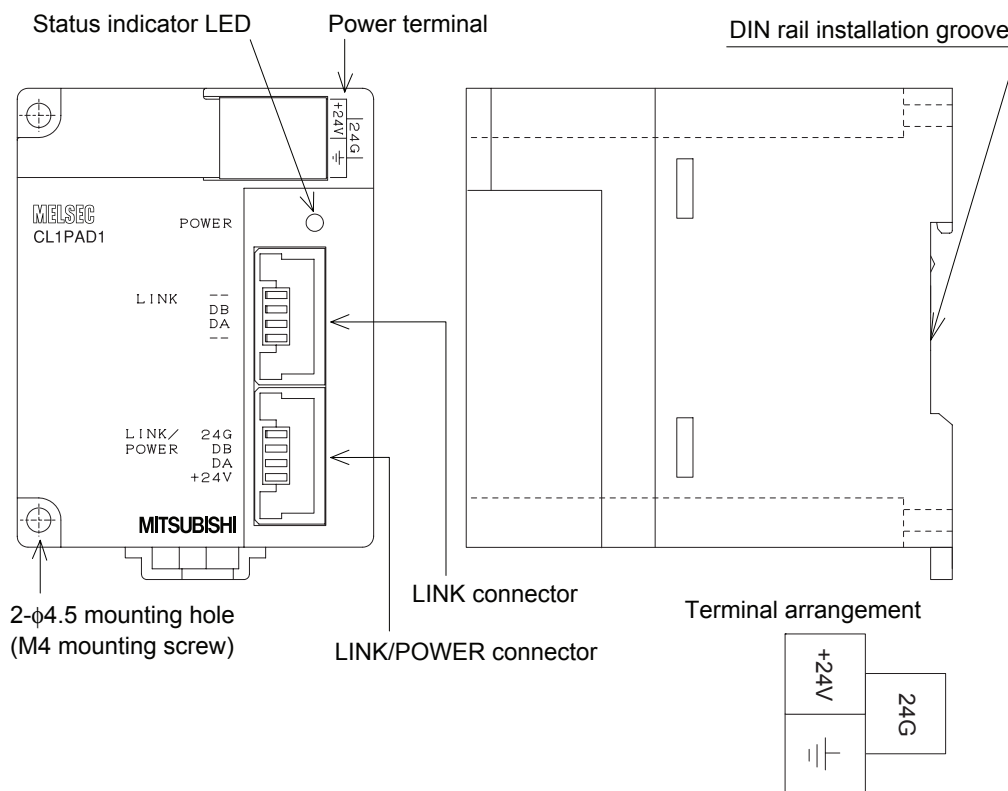
- During transportation avoid the impact which exceeds a regulated value as the power adapter is a precision instrument. It is necessary to check the operation of module after transportation, in case of any impact damage. If not checked, an accident or damage to the machine may result due to a damaged power adapter.

Disposal Procedure

 CAUTION

- When disposing of the product, treat it as industrial waste.

3.1 Name of each part and description



Name		Description	
Status indicator LED	POWER	Lit while the power is supplied	
Interface	LINK connector	DB	For communication
		DA	For communication
	LINK/POWER connector	24G	Power supply for communication (-)
		DB	For communication
		DA	For communication
Power terminal	+24V	Supplies power from an external source to the power adapter. Input voltage: 28.8V DC or less (depending on connected model) Rated input current:5.0 A (Use a proper general-purpose power supply with consideration to the initial current of the remote stations.)	
	24G		
	⊥	Terminal for grounding (100Ω or less)	

4. Specifications (CL1PAD1)

4.1 General specifications

Item	Description		
Ambient operating temperature	0 to 55°C (32 to 131°F)		
Ambient storage temperature	-25 to 75°C (-13 to 167°F)		
Ambient operating humidity	5 to 95%RH: Dew condensation shall not be allowed.		
Ambient storage humidity	5 to 95%RH: Dew condensation shall not be allowed.		
Vibration resistance *1	When intermittent vibration is present		Number of sweep times
	Frequency	Acceleration	Half amplitude
	10 to 57Hz	--	0.075mm
	57 to 150Hz	9.8m/s ²	--
	When continuous vibration is present		10 times in each of the X, Y and Z directions (for 80 min)
	Frequency	Acceleration	
10 to 57Hz	--		
	57 to 150Hz	4.9m/s ²	--
Impact resistance *1	147 m/s ² , 3 times in each of X, Y and Z directions		
Operating atmosphere	Corrosive gas shall not be present.		
Operating altitude	2,000m(6561'8") or less *2		
Installation place	Inside control panel		
Over-voltage category	II or less *3		
Degree of contamination	2 or less *4		

Notes:

*1 The criterion is shown in IEC61131-2.

*2 The module cannot be used in an environment pressurized above atmospheric pressure at the altitude of 0 m. If the module is used in such an environment, it may fail.

*3 This category indicates in which area (inside the site) in relation to the public wiring net the equipment is to be connected.

Category II applies, for example, to equipment whose power is supplied from a fixed facility.

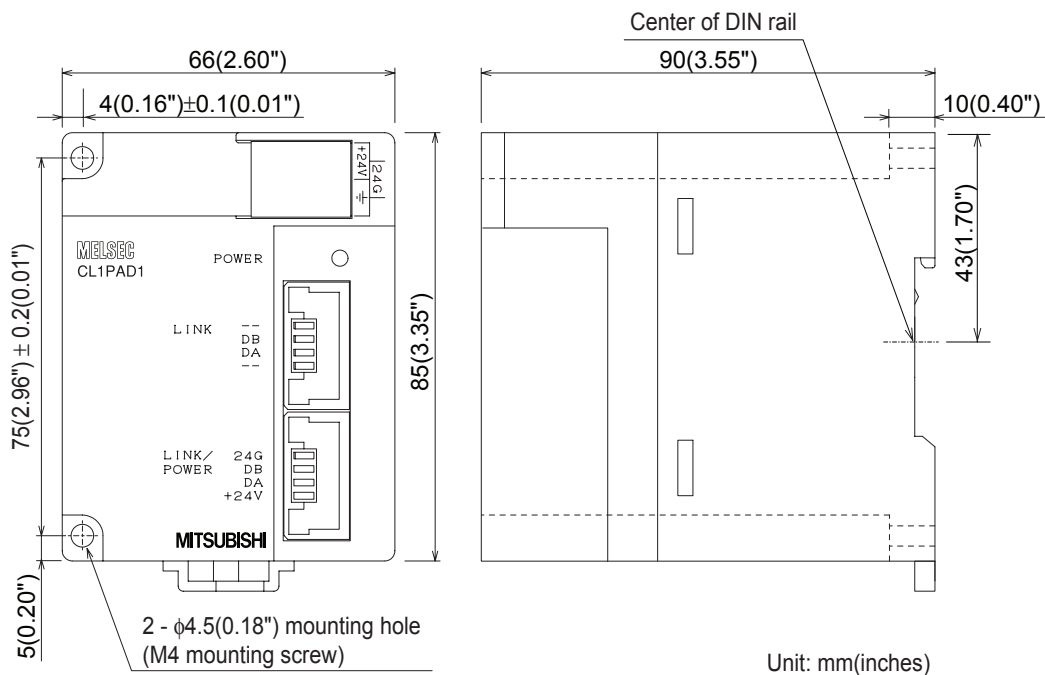
The surge-resistant voltage of equipment rated 300V is 2,500V.

*4 This index indicates the degree of conductive substances generated in the environment in which the module is used. The degree of contamination 2 indicates that contamination is caused by the generation of only non-conductive substances, however, temporary conduction may be caused by accidental condensation.

4.2 Performance specifications


Item	Description
Voltage input range	24V DC (maximum of 28.8V DC)
Maximum ratings current	5.0A (Use the power adapter in the range in which the total current consumption of each module does not exceed the maximum rated current while the power is supplied (except the period immediately after the power is turned on).)
Insulation resistance	10MΩ between the external terminals and the ground terminal by 500V DC megger
External connection method	<ul style="list-style-type: none"> Supplies power from outside to power adapter: 3 points (M3 screws) on terminal block Communication line/module power supply module: Connector (with 4 pins) dedicated to CC-Link/LT × 2
Mass (Weight)	0.26kg (0.58lbs)

4.3 External Dimensions



5. Installation (CL1PAD1)

Installation precautions

 CAUTION

- Use the power adapter in an environment for which the general specifications are described in this manual.
If the power adapter is used in any environment outside the range for the general specifications electrical shock, fire, malfunction, product damage or product deterioration may occur.
- Do not directly touch the conductive area of the power adapter.
Malfunction or damage of the power adapter may be caused by touching the conductive area.
- Securely fix the power adapter on DIN rail or with mounting screws. Securely tighten the mounting screws within the specified torque range (Refer to Subsection 5.1.3).
If the screws are insufficiently tightened, the power adapter may fall, be short-circuited or malfunction.
If the screws are excessively tightened, the screws may be damaged, and the power adapter may fall or be short-circuited.
- Install the power adapter on a flat surface.
If the mounting surface is concave and/or convex, excessive force applied to the PC board may damage the product.
- A dust-proof sheet is included with CL1PAD1.
Make sure the sheet is attached during screw hole processing or wiring work to prevent cuttings and wire chips from entering the module through the ventilation slits.
Otherwise, fire, failure, or malfunction may be caused.
- Take off the dust-proof sheet from the ventilation slits of the product after the engineering work.
Otherwise, fire, failure, or malfunction may be caused.

5.1 Installation method

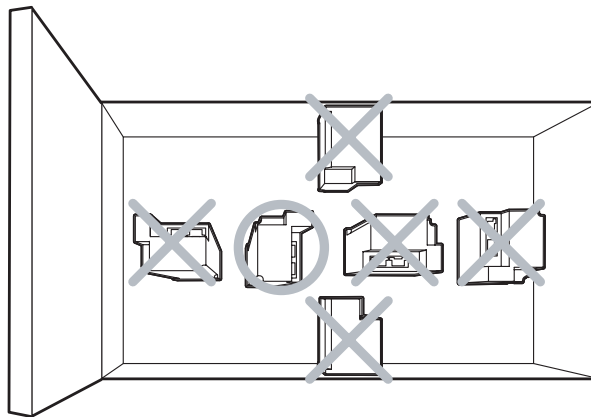
The power adapter can be installed on to DIN rail or directly installed using screws. Assure a distance of 50mm (1.97") or more between the power adapter and other equipment or structures. Keep the power adapter away from high voltage cables or power equipment as much as possible.

Installation procedures are described below.

5.1.1 Installation direction

- Do not install the power adapter on the floor surface, ceiling surface or in a horizontal direction. If the power adapter is installed on such a surface or direction, the temperature may rise.

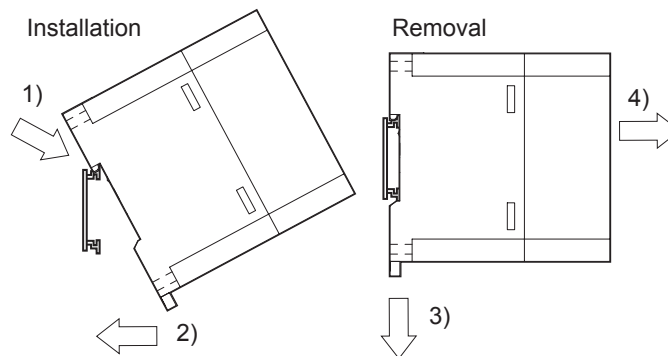
Install the power adapter on the wall vertically.



5.1.2 Installation to DIN rail

Align the upper DIN rail installation groove on the power adapter as described in DIN rail 1), and press the power adapter onto the DIN rail as in 2).

When removing the power adapter, pull the hook downwards as described in DIN rail 3), then remove the power adapter 4).



Applicable DIN rail	TH35-7.5Fe and TH35-7.5Al Width: 35mm (1.38")
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5.1.3 Direct installation

Mount the power adapter by tightening M4 screws to the upper and lower mounting holes (two holes in all) provided on the power adapter.

Applicable screw	M4 height: 16mm(0.63") or more (Tightening torque range: 0.78 to 1.08 N·m)
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6. Power Wiring (CL1PAD1)

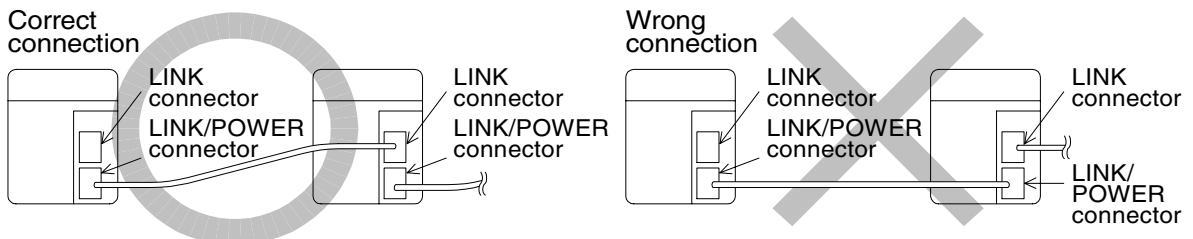
Wiring precaution

⚠ DANGER

- Shut down all external phases of power supply to the module before starting installation or wiring work. If all phases are not shut down, electrical shock or product damage may occur.

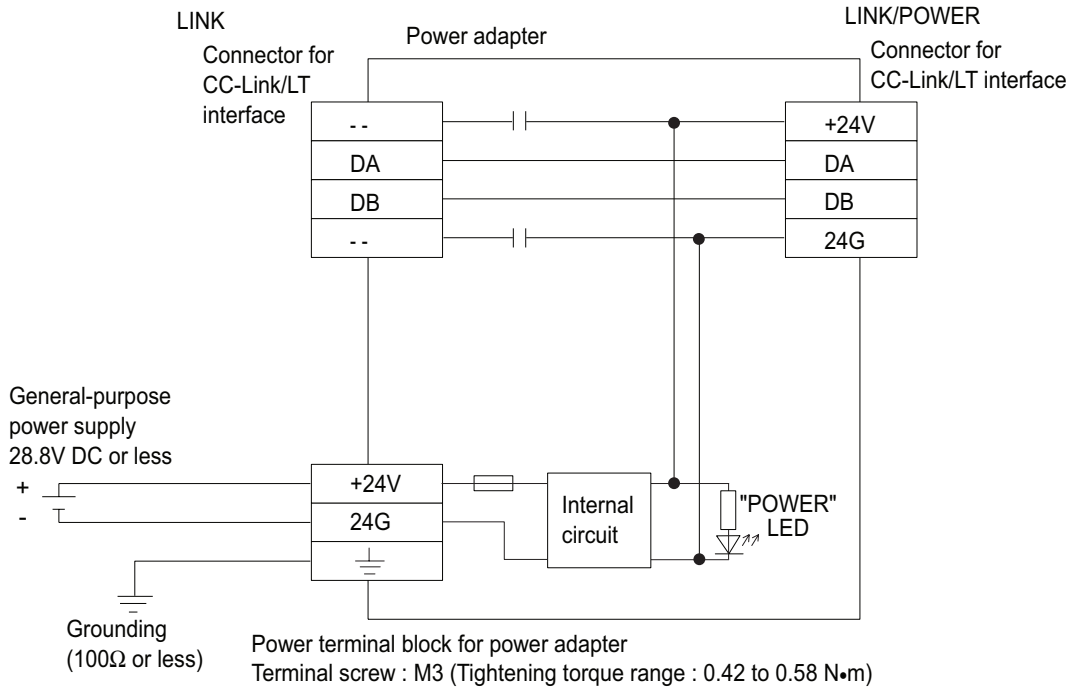
⚠ CAUTION

- Confirm the rated voltage and the terminal arrangement of the power adapter, then correctly wire the power adapter.
If a power supply not conforming to the specified rating is connected or the power adapter is wired incorrectly, fire or failure may occur.
- Tighten the terminal screws within the specified torque range (Refer to Section 6.1).
If the terminal screws are insufficiently tightened, fire or malfunction may occur.
If the terminal screws are excessively tightened, the screws may be damaged, and the module may be short-circuited, equipment failures, or malfunction.
- Make sure that foreign objects such as cuttings and wire chips do not enter the power adapter.
Fire, failure or malfunction may occur.
- When two or more power adapters exist in a system, take care in connecting the first LINK/POWER connector to the second LINK connector as indicated below. If the LINK/POWER connector in the two adapters are connected to each other, the adapters may fail.



- Do not short-circuit the 24G terminal and the +24V terminal of the LINK/POWER connector. Some remote I/O stations operate the inputs and outputs using the power supply for communication. Refer to the corresponding manuals for remote I/O stations and perform wiring correctly.
If wiring is performed incorrectly, fire, failure or malfunction may occur.
- When the LINK connector is not in use, cover the opening by plugging a connector for communication (without any cable) or attaching a piece of tape to prevent dust or conductive foreign materials from entering the module. Such materials may cause failure or malfunction.
- Attach a warning label (hazard symbol 417-IEC-5036) concerning electric shock to the enclosure of the final system.

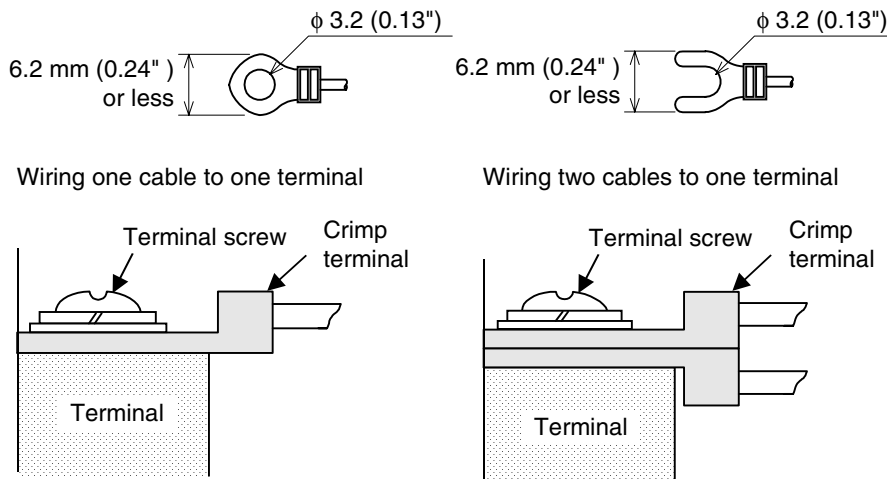
6.1 Power wiring diagram



- The general-purpose power supply is to be prepared by the user.
- Use a proper general-purpose power supply with consideration for total current consumption and total initial current of remote stations and I/O equipment (such as sensors) connected to the power adapter.

6.2 Crimp-style terminal

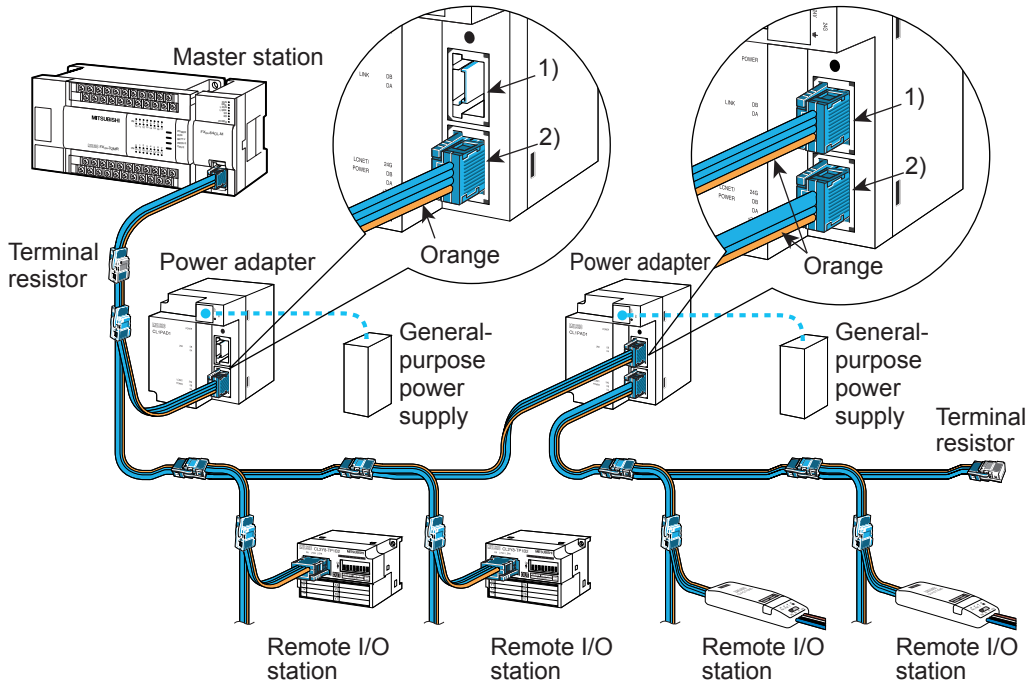
For power wiring, use crimp terminals of the following dimensions.



Applicable crimp terminal	RAV1.25-3 V1.25-3 (manufactured by JST Mfg. Co., Ltd.) 1.25-3 and TG1.25-3 (manufactured by NICHIFU Co., Ltd.)
Applicable wire size	0.3 to 1.25 mm ²

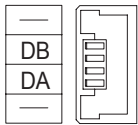
- Do not tighten terminal screws exceeding the specified torque. Failure to do so may cause short circuit, equipment failures, or malfunctions.

6.3 Handling of LINK and LINK/POWER connector



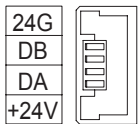
1) LINK connector

Pin assignment Dedicated for communication only (does not supply power).
Used when two or more power adapters are used in the CC-Link/LT system.



2) LINK/POWER connector

Pin assignment Executes communication and supplies power to the CC-Link/LT system.

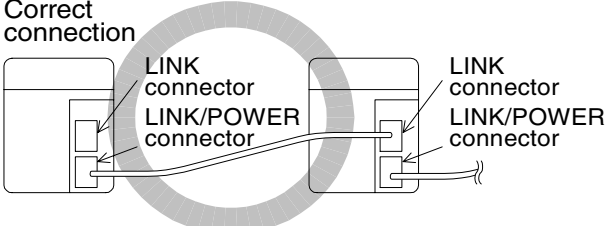


Wiring precautions

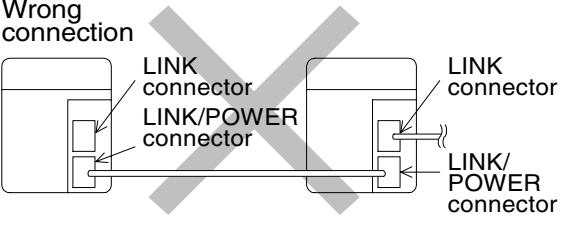
⚠ CAUTION

- When two or more power adapters exist in a system, take care in connecting the first LINK/POWER connector to the second LINK connector as indicated below. If the LINK/POWER connector in the two adapters are connected to each other, the adapters may fail.

Correct connection




Wrong connection



- Do not short-circuit the 24G terminal and the +24V terminal of the LINK/POWER connector. Some remote I/O stations operate the inputs and outputs using the power supply for communication. Refer to the corresponding manuals for remote I/O stations and perform wiring correctly.
If wiring is performed incorrectly, fire, failure or malfunction may occur.

7. Cautions on Construction (CL1PAD1)

Startup/maintenance precautions

 DANGER

- Do not touch the terminals while the power is supplied.
Electrical shock or malfunction may be caused by touching the terminals.
- Make sure to shut down all external phases of the power supply before cleaning or tightening the terminal screws.
If all phases are not shut down, the power adapter may fail or malfunction.

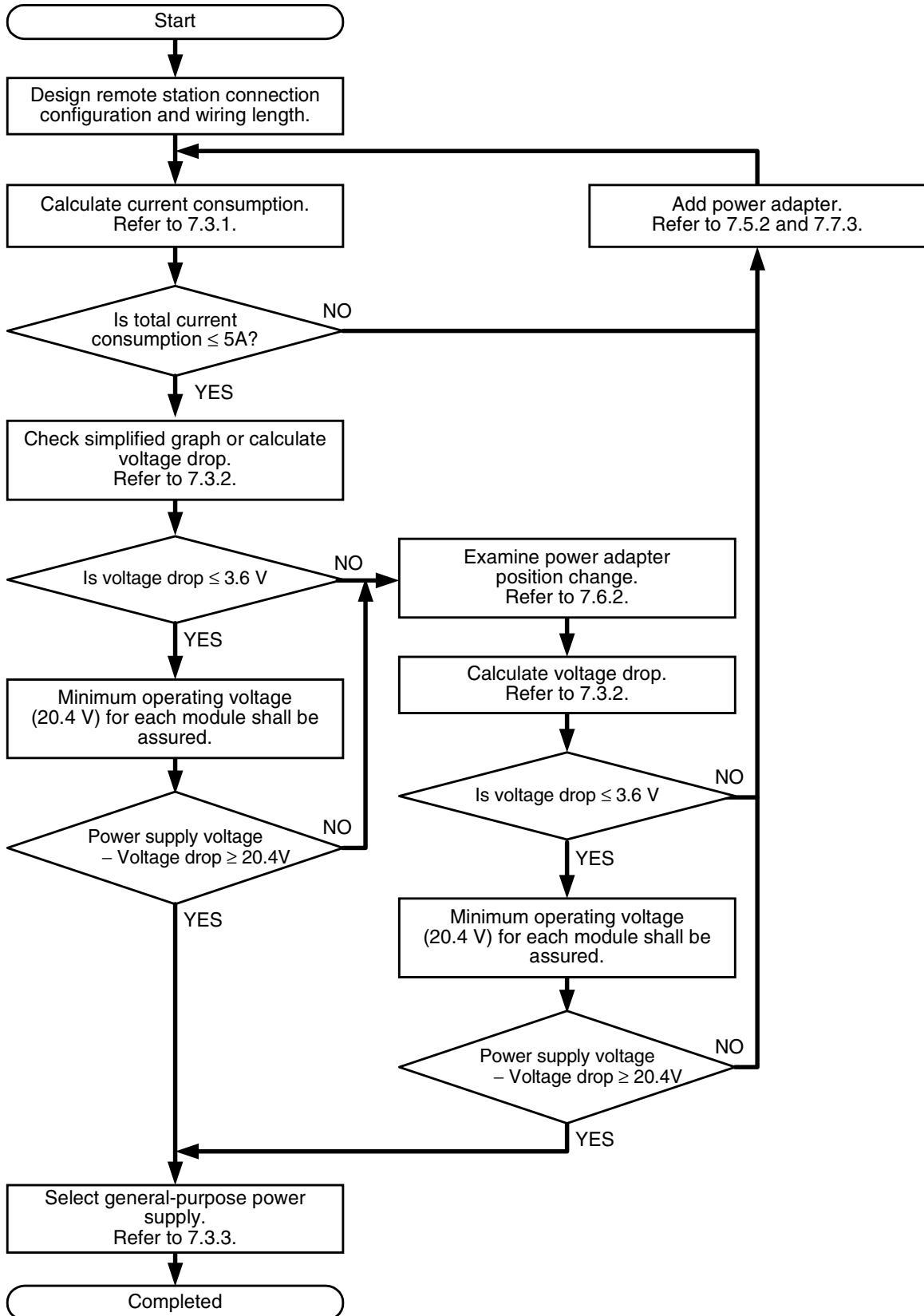
 CAUTION

- Do not disassemble or modify the power adapter.
Failure, malfunction, injury or fire may be caused by any disassembly or modification.
- The power adapter case is made of a resin.
The power adapter may be damaged by dropping or strong impact.
- Shut down all external phases of the power supply before attaching or removing the power adapter to/from the panel.
If all phases are not shut down, the power adapter may fail or malfunction.

7.1 System power calculation procedure

Calculate the system power using the following procedure.

Calculation procedure



7.2 Installation concept of power adapters

7.2.1 Number of power adapters

When constructing the system using only one power adapter, the following three conditions should be satisfied.

If the following three conditions are not satisfied, the use of two or more power adapters should be considered in constructing the system.

- 1) Because the current capacity of the power adapter is 5A, the total current consumption of remote stations, I/O equipment and the master station receiving the power from the power adapter $\leq 5A$.
- 2) To operate the system in a stable environment, the voltage drop should be equivalent to or less than 3.6V.
- 3) As the minimum operating voltage from the power adapter is 20.4V for each remote module, Supply voltage to power adapter - Voltage drop $\geq 20.4V$.

There is a formula (Refer to section 7.3.) to test the system configuration with regard to the voltage drop of the cable.

If the total current consumption or the voltage drop due to the cable is too large, take the following countermeasures.

When the total current consumption is large or the minimum operating voltage (20.4V DC) for each station is not assured

- Add power adapters or dedicated power supplies.
(Use several power adapters or dedicated power supplies so that the power supplied to the system is divided accordingly.)

When the voltage drop is large or the minimum operating voltage (20.4V DC) of each station is not assured

- Change the power adapter position.
(Shorten the maximum distance from the power adapter to a remote station or the master station.)
- Shorten the connection cable
(Shorten the maximum distance from the power adapter to a remote station or the master station.)
- Add power adapters or dedicated power supplies.
(Use several power adapters or dedicated power supplies so that the power supplied to the system is divided accordingly.)

7.2.2 Rule when using two or more power adapters

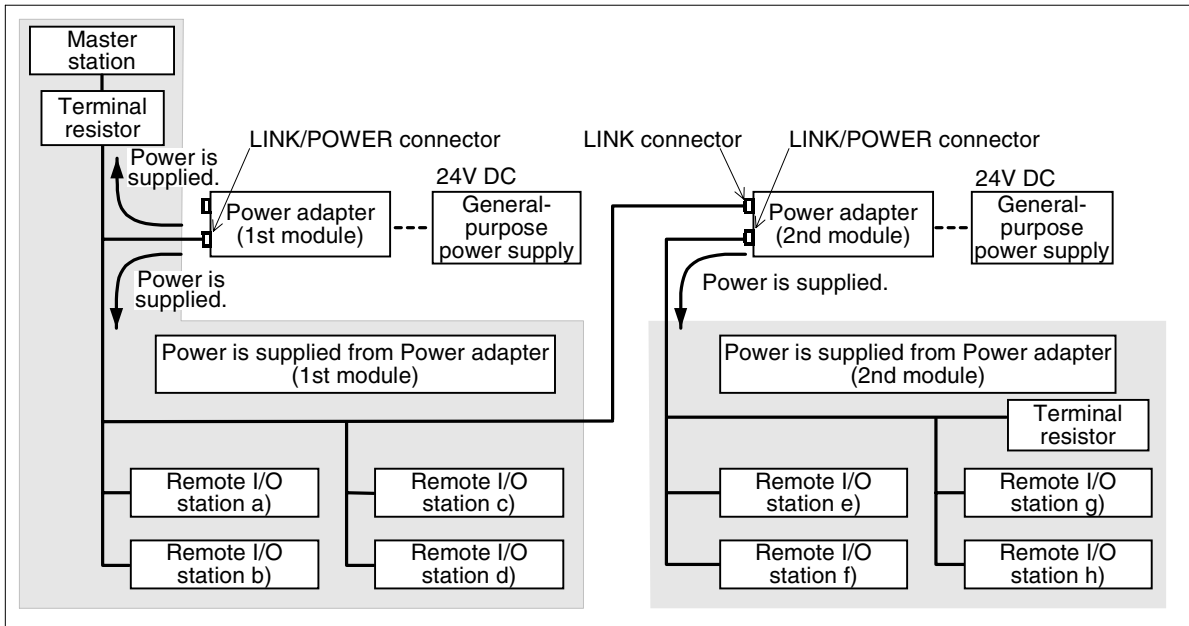
Two or more power adapters can be used in a system.

(A power adapter and a dedicated power supply can be used concurrently.)

When using two or more power adapters, calculate the 'Current consumption', 'Voltage drop', and 'Minimum operating voltage (20.4V DC)' for each power adapter and construct the system so that each condition is satisfied.

(Refer to 7.3.3 when selecting a general-purpose power supply connected to each power adapter.)

System configuration example



1) Current consumption calculation

Current consumption calculation in power adapter (1st module)	=	Total current consumption in master station and remote I/O station a) to d) *1
Current consumption calculation in power adapter (2nd module)	=	Total current consumption in remote I/O station e) to h) *1

2) Start-up current calculation

Start-up current calculation supplied from power adapter (1st module)	=	Total current of master station and remote I/O station a) to d) at start-up *1
Start-up current calculation supplied from power adapter (2nd module)	=	Total current of remote I/O station e) to h) at start-up *1

3) Voltage drop calculation

Voltage drop calculation supplied from power adapter (1st module)	=	Calculate voltage drop in master station and remote I/O station a) to d) based on current consumption and distance to the furthest station.
Voltage drop calculation supplied from power adapter (2nd module)	=	Calculate voltage drop in remote I/O station e) to h) based on current consumption and distance to the furthest station.

4) Confirmation related to the minimum operating voltage (20.4V DC) of the module

Minimum operating voltage (20.4V DC) from power adapter (1st module)

=

Output voltage of power adapter (1st module) -voltage drop $\geq 20.4V$
--

Minimum operating voltage (20.4V DC) from power adapter (2nd module)

=

Output voltage of power adapter (2nd module) -voltage drop $\geq 20.4V$
--

*1 If a remote I/O module supplies power to the connected I/O equipment, the current consumption in the I/O equipment also needs to be included in the calculation.

7.3 System power calculation method

7.3.1 Current consumption calculation

Using the formula below, calculate the total current consumption of the remote stations, I/O equipment and the master station receiving power from the power adapter.

$$\boxed{\begin{array}{c} \text{Current} \\ \text{consumption in} \\ \text{CC-Link/LT} \\ \text{system} \end{array}} = \boxed{\begin{array}{c} \text{Total current} \\ \text{consumption of} \\ \text{each module in} \\ \text{CC-Link/LT system} \end{array}} + \boxed{\begin{array}{c} \text{Total current consumption of I/O} \\ \text{equipment (such as sensors)} \\ \text{(to which power is supplied via} \\ \text{communication cable)*1} \end{array}} \leq 5A$$

Notes:

*1 Some remote I/O stations for CC-Link/LT supply the power for I/O via a connection cable. For details, refer to the instruction manual of each remote I/O station.

7.3.2 Voltage drop

The voltage drop can be calculated using the "1) Simplified graph" or "2) Calculation formula". The voltage drop is in proportion to the length of connection cable and the current consumption of connected modules.

Calculate the voltage drop with respect to the cable length up to a remote station or the master station that is located furthest from the power adapter.

- 1) Selection based on the simplified graph
(at supply voltage: 24V DC, ambient temperature: 20°C)

The graph on the right shows the relationship between current consumption (A) and the cable length (m(inches)) that causes a voltage drop of 3.6 V.

If the relationship between the current consumption and the cable length is within the shaded range of the graph, a system can be configured using only one power adapter.

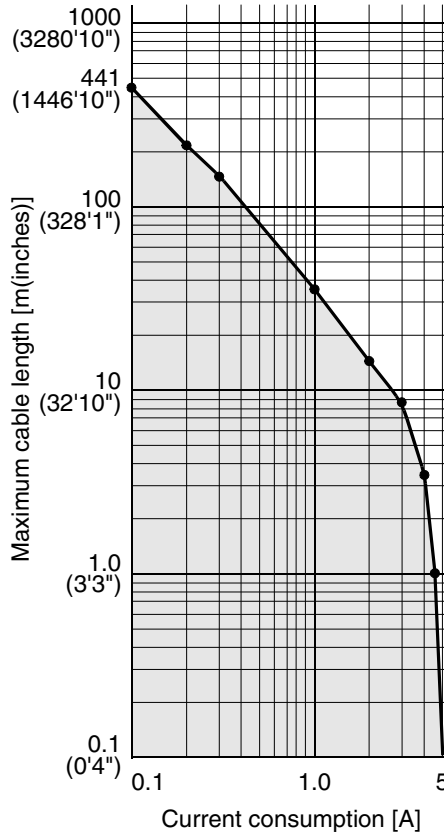
However, the available main line length, branch line

length and total branch line length are restricted by transmission speed.

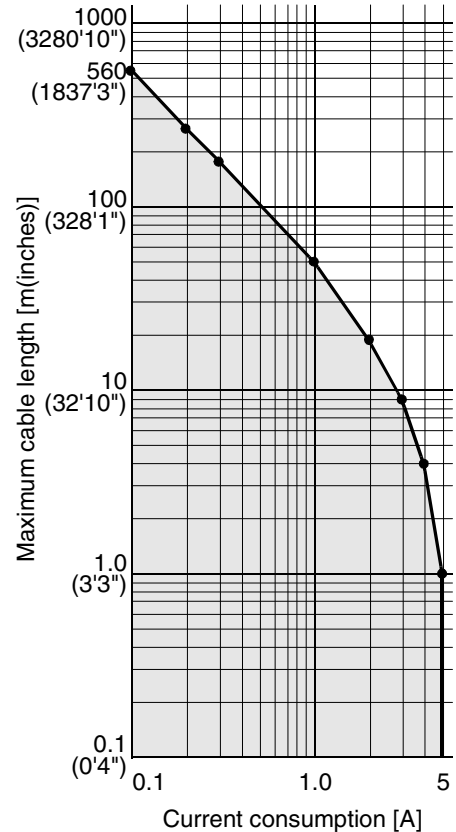
- Maximum cable length:

Cable length between the power adapter and a remote station or the master station located furthest from the power adapter

When you use VCTF cable, High flexible cable or a combination of cables



When you use dedicated flat cable



2) Selection based on the calculation formula
 (at supply voltage: 24V DC, ambient temperature: 20°C)

- When you use VCTF cable, High flexible cable or a combination of cables

$$\boxed{\text{Voltage drop (V)}} = \boxed{\text{Maximum distance (m) + Constant: 9}} \times \boxed{\text{Constant : 0.08}} \times \boxed{\text{Total current consumption (A)}} \leq 3.6V$$

- When you use dedicated flat cable

$$\boxed{\text{Voltage drop (V)}} = \boxed{\text{Maximum distance (m) + Constant: 11}} \times \boxed{\text{Constant : 0.06}} \times \boxed{\text{Total current consumption (A)}} \leq 3.6V$$

Maximum distance	Distance from power adapter, to the furthest station receiving power from the power adapter in question. A station that is powered by another power adapter further along the network should not be considered.	
Total current consumption	Total current consumption of each unit within the CC-Link/LT system receiving power from the power adapter in question. A station that is powered by another power adapter further along the network should not be considered.	+ Total current consumption of the I/O equipment (such as sensors to which power is supplied via a connection cable *1) connected to each unit within the CC-Link/LT system receiving power from the power adapter in question. A station that is powered by another power adapter further along the network should not be considered.

*1 Some remote I/O stations for CC-Link/LT supply power for I/O via a connection cable. For the details, refer to the instruction manual of each remote I/O station.

When the current consumption is determined, the distance from the power adapter to the furthest station can be obtained from the following formula.

- When you use VCTF cable, High flexible cable or a combination of cables

$$\boxed{\text{Maximum distance (m)}} \leq 3.6V \div \boxed{\text{Total current consumption (A)}} \div \boxed{0.08 \text{ (Constant)}} - \boxed{9 \text{ (Constant)}}$$

- When you use dedicated flat cable

$$\boxed{\text{Maximum distance (m)}} \leq 3.6V \div \boxed{\text{Total current consumption (A)}} \div \boxed{0.06 \text{ (Constant)}} - \boxed{11 \text{ (Constant)}}$$

Or when the distance from the power adapter to the furthest station is determined, the allowable current consumption can be obtained from the formula below.

- When you use VCTF cable, High flexible cable or a combination of cables

$$\boxed{\text{Total current consumption (A)}} \leq 3.6V \div \boxed{0.08 \text{ (Constant)}} \div \boxed{\text{Maximum distance (m) + 9 (Constant)}}$$

- When you use dedicated flat cable

$$\boxed{\text{Total current consumption (A)}} \leq 3.6V \div \boxed{0.06 \text{ (Constant)}} \div \boxed{\text{Maximum distance (m) + 11 (Constant)}}$$

The simplified graph and the calculation formula for voltage drop may not always be accurate as effects such as ambient temperature and the number of connectors used can influence the results.

If the conditions of "5.1 Installation concept of power adapters" are not satisfied, more than one power adapter should be considered when constructing the system.

And if the driving voltage (20.4 V) cannot be assured in a remote station, take proper countermeasures. (Refer to 7.1.)

$$\boxed{\text{General-purpose power supply voltage}} - \boxed{\text{Voltage drop}} \geq 20.4V$$

7.3.3 Selection of general-purpose power supply

The general-purpose power supply connected to the power adapter must satisfy all the following conditions.

If the following conditions are not satisfied, for example, due to a change in the system, then changing the general-purpose power supply or using two or more power adapters should be considered.

- 1) The power source must supply a minimum of 20.4V DC to the CC-Link/LT system for the I/O modules to operate correctly.

Do not exceed the maximum input voltage (28.8V DC) of the power adapter.

(For the calculation of the voltage drop, refer to '7.3.2 Voltage drop'.)

$$20.4V + \text{voltage drop} \leq \text{General purpose power supply output voltage} \leq 28.8V$$

- 2) Select a general-purpose power supply (general-purpose power supply used to supply 24V DC to the power adapter) whose rated current can cope with the value obtained in the "Total current consumption".

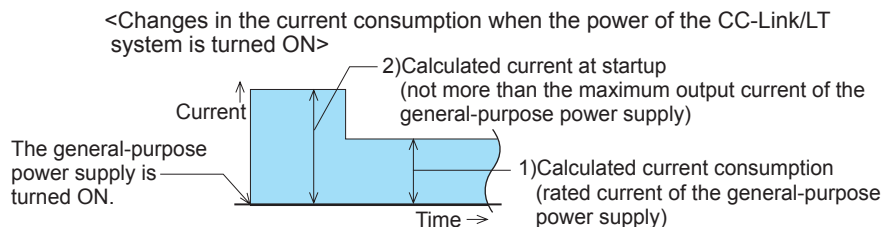
$$\text{Rated output current of general-purpose power supply} \geq \text{Total current consumption}$$

- 3) Select a general-purpose power supply whose maximum output current*1 can cope with the calculated current value expected at the start-up of the CC-Link/LT system (when the power is turned on).

Notes:

*1 Maximum output current: May be referred to as "peak output current". If there is no description concerning maximum output current, use the threshold value of the "high current limiting function".

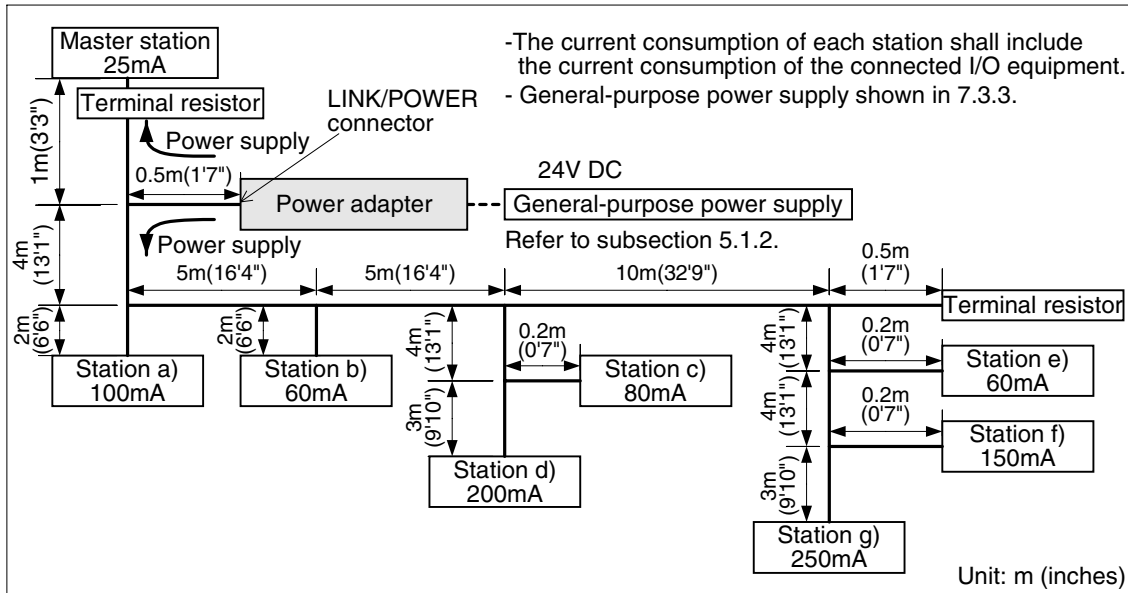
Maximum output current of general-purpose power supply \geq Total current at startup of each module in CC-Link/LT system + Total current consumption of I/O modules (such as sensors)



7.4 System configuration example 1

This section describes a configuration example when both the current consumption and the voltage drop are minimal.

System configuration example



1) Current consumption calculation

Total current consumption

$$25\text{mA} + 100\text{mA} + 60\text{mA} + 80\text{mA} + 200\text{mA} + 60\text{mA} + 150\text{mA} + 250\text{mA} = 925\text{mA} = 0.925\text{A} \leq 5\text{A}$$

Master station Station a) Station b) Station c) Station d) Station e) Station f) Station g)

2) Voltage drop calculation

$$(35.5\text{m}(116'5'') + \text{Constant: } 11) \times \text{Constant: } 0.06 \times 0.925\text{A} = 2.581\text{V} \leq 3.6\text{V}$$

Maximum distance:

From the power adapter to the farthest station = Station g)

$$0.5\text{m}(1'7'') + 4\text{m}(13'1'') + 5\text{m}(16'4'') + 5\text{m}(16'4'') + 10\text{m}(32'9'') + 4\text{m}(13'1'') + 4\text{m}(13'1'') + 3\text{m}(9'10'') = 35.5\text{m}(116'5'')$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

$$24\text{V} - 2.581\text{V} = 21.419\text{V} \geq 20.4\text{V}$$

From 1), 2) and 3) above, the system can be configured using only one power adapter with regard to both the current and voltage restrictions.

7.5 System configuration example 2 (when current consumption is large)

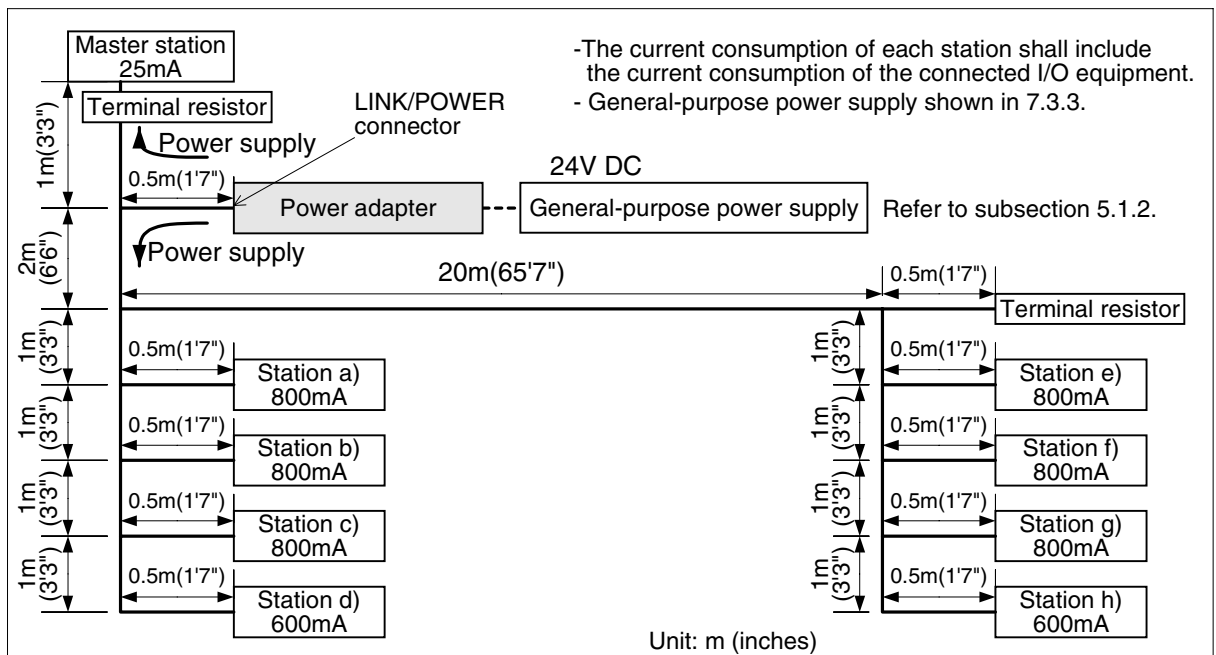
This section describes a configuration example and countermeasures needed in the case when the current consumption is too large.

When the current consumption is large, increase the number of power adapters without regard to the voltage drop value so that the total current consumption of the modules connected to each power adapter is 5 A or less.

7.5.1 System configuration example having large current consumption

In the system configuration example shown below, the total current consumption of the connected modules exceeds 5 A.

System configuration example



1) Current consumption calculation

Total current consumption

$$25\text{mA} + 800\text{mA} + 800\text{mA} + 800\text{mA} + 600\text{mA} + 800\text{mA} + 800\text{mA} + 800\text{mA} + 800\text{mA} = 6025\text{mA} = 6.025\text{A} > 5\text{A}$$

Master station Station a) Station b) Station c) Station d) Station e) Station f) Station g) Station h)

2) Voltage drop calculation

$$(27\text{m}(88'6'') + \text{Constant: } 11) \times \text{Constant: } 0.06 \times 6.025\text{A} = 13.737\text{V} > 3.6\text{V}$$

Maximum distance: From the power adapter to the furthest station = Station h)

$$0.5\text{m}(1'7'') + 2\text{m}(6'6'') + 20\text{m}(65'7'') + 1\text{m}(3'3'') + 1\text{m}(3'3'') + 1\text{m}(3'3'') + 1\text{m}(3'3'') + 0.5\text{m}(1'7'') = 27\text{m}(88'6'')$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

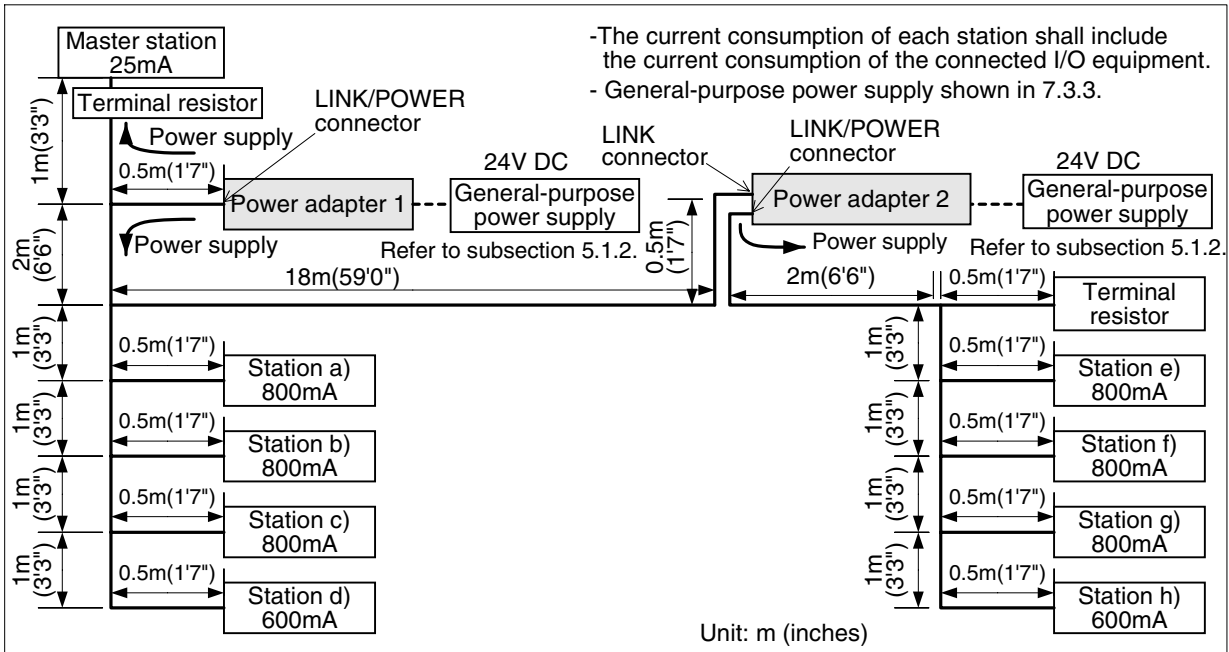
$$24\text{V} - 13.737\text{V} = 10.263\text{V} < 20.4\text{V}$$

From 1), 2) and 3) above, the system cannot be configured using only one power adapter with regard to both the current and voltage restrictions. Add a power adapter as shown in the next page.

7.5.2 Countermeasures (addition of power adapter)

When the current consumption exceeds 5 A, add power adapters in constructing the system so that the total current consumption of modules connected to each power adapter is 5 A or less.

System configuration example when two power adapters are used



1) Current consumption calculation

Total current consumption in the power adapter 1

$$25\text{mA} + 800\text{mA} + 800\text{mA} + 800\text{mA} + 600\text{mA} = 3025\text{mA} = 3.025\text{A} \leq 5\text{A}$$

Master station Station a) Station b) Station c) Station d)

Total current consumption in the power adapter 2

$$800\text{mA} + 800\text{mA} + 800\text{mA} + 600\text{mA} = 3000\text{mA} = 3\text{A} \leq 5\text{A}$$

Station e) Station f) Station g) Station h)

2) Voltage drop calculation

Voltage drop in the power adapter 1

$$(7\text{m}(22'11\text{''}) + \text{Constant:}11) \times \text{Constant:} 0.06 \times 3.025\text{A} = 3.267\text{V} \leq 3.6\text{V}$$

Maximum distance: From the power adapter to the furthest station = Station d)

$$0.5\text{m}(1'7\text{''}) + 2\text{m}(6'6\text{''}) + 1\text{m}(3'3\text{''}) + 1\text{m}(3'3\text{''}) + 1\text{m}(3'3\text{''}) + 1\text{m}(3'3\text{''}) + 0.5\text{m}(1'7\text{''}) = 7\text{m}(22'11\text{''})$$

Voltage drop in the power adapter 2

$$(7\text{m}(22'11\text{''}) + \text{Constant:}11) \times \text{Constant:} 0.06 \times 3\text{A} = 3.24\text{V} \leq 3.6\text{V}$$

Maximum distance: From the power adapter to the furthest station = Station h)

$$0.5\text{m}(1'7\text{''}) + 2\text{m}(6'6\text{''}) + 1\text{m}(3'3\text{''}) + 1\text{m}(3'3\text{''}) + 1\text{m}(3'3\text{''}) + 1\text{m}(3'3\text{''}) + 0.5\text{m}(1'7\text{''}) = 7\text{m}(22'11\text{''})$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

Power adapter 1: $24\text{V} - 3.267\text{V} = 20.733\text{V} \geq 20.4\text{V}$

Power adapter 2: $24\text{V} - 3.24\text{V} = 20.76\text{V} \geq 20.4\text{V}$

From 1), 2) and 3) above, the system can be configured using two power adapters with regard to both the current and voltage restrictions.

7.6 System configuration example 3 (when the voltage drop is large)

This section describes a configuration example and countermeasures needed in the case when the voltage drop is too large.

When the voltage drop is large, please change the power adapter position.

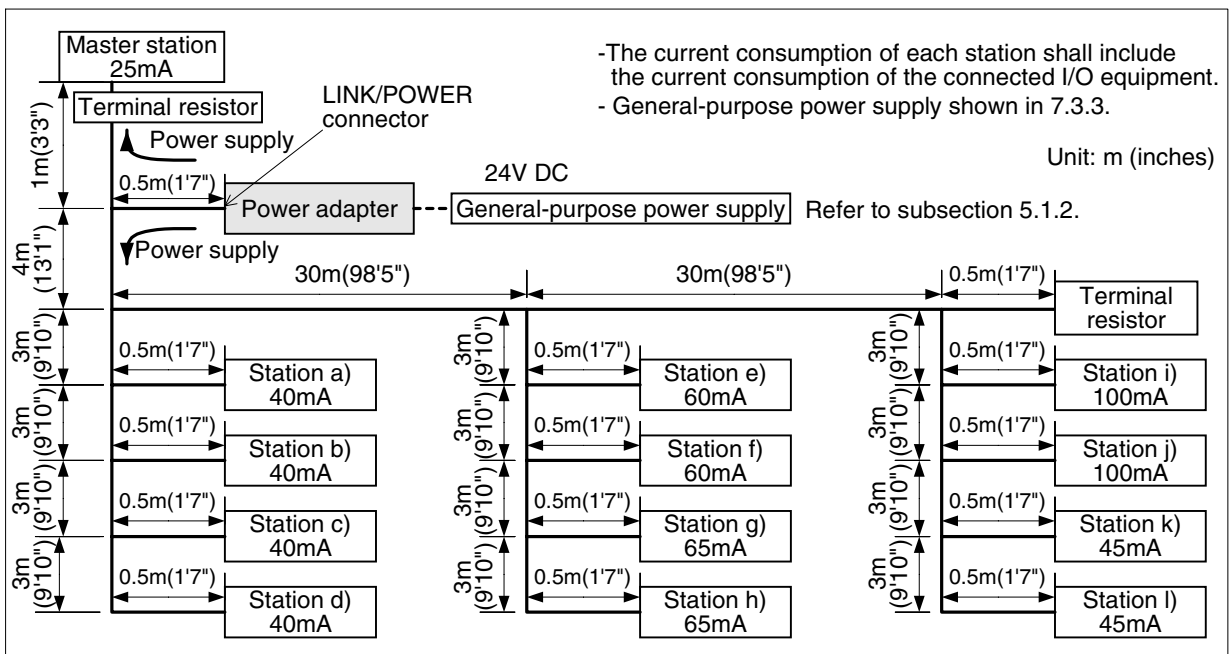
When the minimum operating voltage (20.4 V) for each module connected to the power adapter cannot be assured even if the power adapter position is changed, increase the number of power adapters. (Refer to 7.7.)

When the current consumption is also too large, increase the number of used power adapters. (Refer to 7.5.)

7.6.1 System configuration example disabling operation

In the system configuration example shown below, some modules cannot operate normally because the voltage drop is too large.

System configuration example



1) Current consumption calculation

Total current consumption

$$\begin{aligned}
 & \boxed{25\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{60\text{mA}} + \boxed{60\text{mA}} + \boxed{65\text{mA}} + \boxed{65\text{mA}} \\
 & \text{Master station} \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\
 & \quad \quad \quad + \boxed{100\text{mA}} + \boxed{100\text{mA}} + \boxed{45\text{mA}} + \boxed{45\text{mA}} = \boxed{725\text{mA}} = \boxed{0.725\text{A}} < \boxed{5\text{A}} \\
 & \quad \quad \quad \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)}
 \end{aligned}$$

2) Voltage drop calculation

$$\boxed{(77\text{m}(252'7'') + \text{Constant:}11)} \times \boxed{\text{Constant:}0.06} \times \boxed{0.725\text{A}} = \boxed{3.828\text{V}} > \boxed{3.6\text{V}}$$

Maximum distance: From the power adapter to the furthest station = Station l)

$$\begin{aligned}
 & \boxed{0.5\text{m}(1'7'')} + \boxed{4\text{m}(13'1'')} + \boxed{30\text{m}(98'5'')} + \boxed{30\text{m}(98'5'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} \\
 & \quad \quad \quad + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{0.5\text{m}(1'7'')} = \boxed{77\text{m}(252'7'')}
 \end{aligned}$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

$$24\text{V} - 3.828\text{V} = 20.172\text{V} < 20.4\text{V}$$

From 2) and 3) above, the system cannot be supported because the voltage drop is too large. Change the power adapter position as shown in the next page.

7.6.2 Countermeasures (changing the power adapter position)

When the current consumption is determined, the maximum allowable distance can be obtained using the following formula.

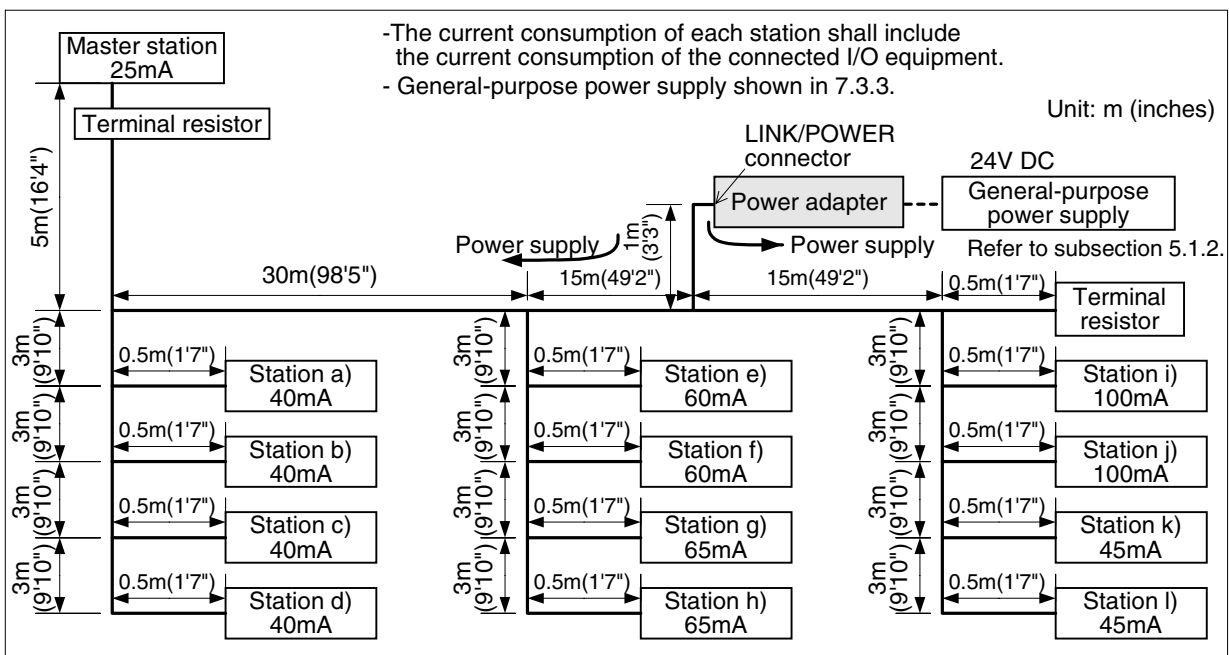
$$\text{Max. distance (m(inches))} \leq \frac{3.6(\text{V})}{\text{Total current consumption (A)}} \div 0.06 (\text{constant}) - 11 (\text{constant})$$

In this example, the maximum allowable distance is as follows.

$$\begin{aligned} \text{Max. distance (m(inches))} &\leq \frac{3.6(\text{V})}{0.725(\text{A})} \div 0.06 (\text{constant}) - 11 (\text{constant}) \\ &\leq 71.75862(\text{m})(235'2'') \end{aligned}$$

Accordingly, the power adapter can be connected in such a position that the distance between the power adapter and a remote station or the master station located furthest from the power adapter is approximately less than 71.7 (m) (235' 2").

System configuration example when the power adapter position is changed.



1) Current consumption calculation

Total current consumption

$$\begin{aligned} &25\text{mA} + 40\text{mA} + 40\text{mA} + 40\text{mA} + 40\text{mA} + 60\text{mA} + 60\text{mA} + 65\text{mA} + 65\text{mA} \\ &\text{Master station} \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\ &+ 100\text{mA} + 100\text{mA} + 45\text{mA} + 45\text{mA} = 725\text{mA} = 0.725\text{A} < 5\text{A} \\ &\quad \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)} \end{aligned}$$

2) Voltage drop calculation

$$(58.5\text{m}(191'11'') + \text{Constant:}11) \times \text{Constant:} 0.06 \times 0.725\text{A} = 3.02325\text{V} \leq 3.6\text{V}$$

Maximum distance: From the power adapter to the furthest station = Station d)

$$\begin{aligned} &1\text{m}(3'3'') + 15\text{m}(49'2'') + 30\text{m}(98'5'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') \\ &+ 0.5\text{m}(1'7'') = 58.5\text{m}(191'11'') \end{aligned}$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

$$24\text{V} - 3.02325\text{V} = 20.97675\text{V} \geq 20.4\text{V}$$

From 1), 2) and 3) above, the system can be configured using only one power adapter with regard to both the current and voltage restrictions.

7.7 System configuration example 4 (when the voltage drop is large)

This section describes a configuration example and countermeasures needed in the case when the voltage drop is large, and the minimum operating voltage (20.4 V) for each module connected to the power adapter cannot be satisfied even if the power adapter position is changed.

When the voltage drop is large, change the voltage drop position as described in "7.6 System configuration example 3". However, in some conditions, the minimum operating voltage (20.4 V) for each module connected to the power adapter cannot be satisfied even if the power adapter position is changed.

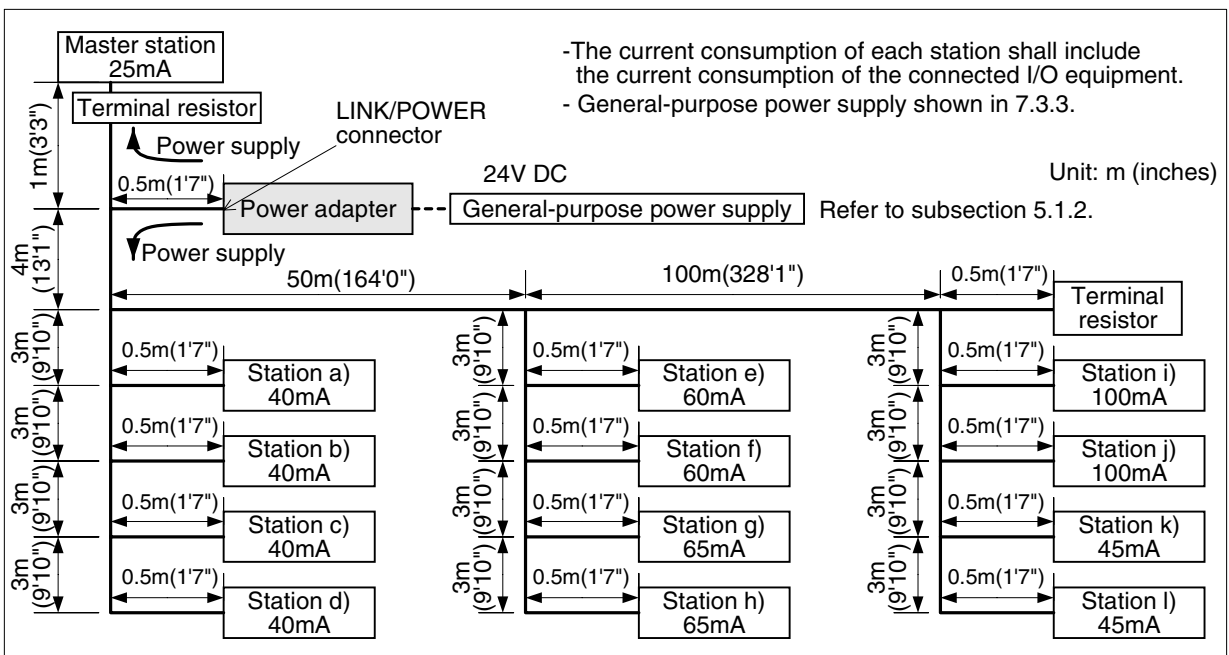
Therefore, increase the number of power adapters so that the minimum operating voltage (20.4 V) for each module is satisfied.

Also when the current consumption is too large, increase the number of power adapters. (Refer to 7.5.)

7.7.1 System configuration example 1 disabling operation

In the system configuration example shown below, some modules cannot operate normally because the voltage drop is large.

System configuration example



1) Current consumption calculation

Total current consumption

$$\begin{aligned}
 & \boxed{25\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{60\text{mA}} + \boxed{60\text{mA}} + \boxed{65\text{mA}} + \boxed{65\text{mA}} \\
 \text{Master station} & \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\
 & + \boxed{100\text{mA}} + \boxed{100\text{mA}} + \boxed{45\text{mA}} + \boxed{45\text{mA}} = \boxed{725\text{mA}} = \boxed{0.725\text{A}} < \boxed{5\text{A}} \\
 & \quad \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)}
 \end{aligned}$$

2) Voltage drop calculation

$$(167\text{m}(547'10") + \text{Constant:}11) \times \text{Constant: } 0.06 \times 0.725\text{A} = 7.743\text{V} > 3.6\text{V}$$

Maximum distance: From the power adapter to the furthest station = Station I)

$$\begin{aligned} &0.5\text{m}(1'7") + 4\text{m}(13'1") + 50\text{m}(164'0") + 100\text{m}(328'1") + 3\text{m}(9'10") + 3\text{m}(9'10") \\ &+ 3\text{m}(9'10") + 3\text{m}(9'10") + 0.5\text{m}(1'7") = 167\text{m}(547'10") \end{aligned}$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

$$24\text{V} - 7.743\text{V} = 16.257\text{V} < 20.4\text{V}$$

From 2) and 3) above, the system cannot be supported because the voltage drop is too large. Add a power adapter as described in 7.7.3. The fact that the system cannot be supported in this example even if the power adapter position is changed is described in the next page.

7.7.2 System configuration example 2 disabling operation (even if power adapter position is changed)

When the current consumption is determined, the maximum allowable distance can be obtained using the following formula.

$$\text{Max. distance (m(inches))} \leq 3.6(\text{V}) \div \text{Total current consumption (A)} \div 0.06 (\text{constant}) - 11 (\text{constant})$$

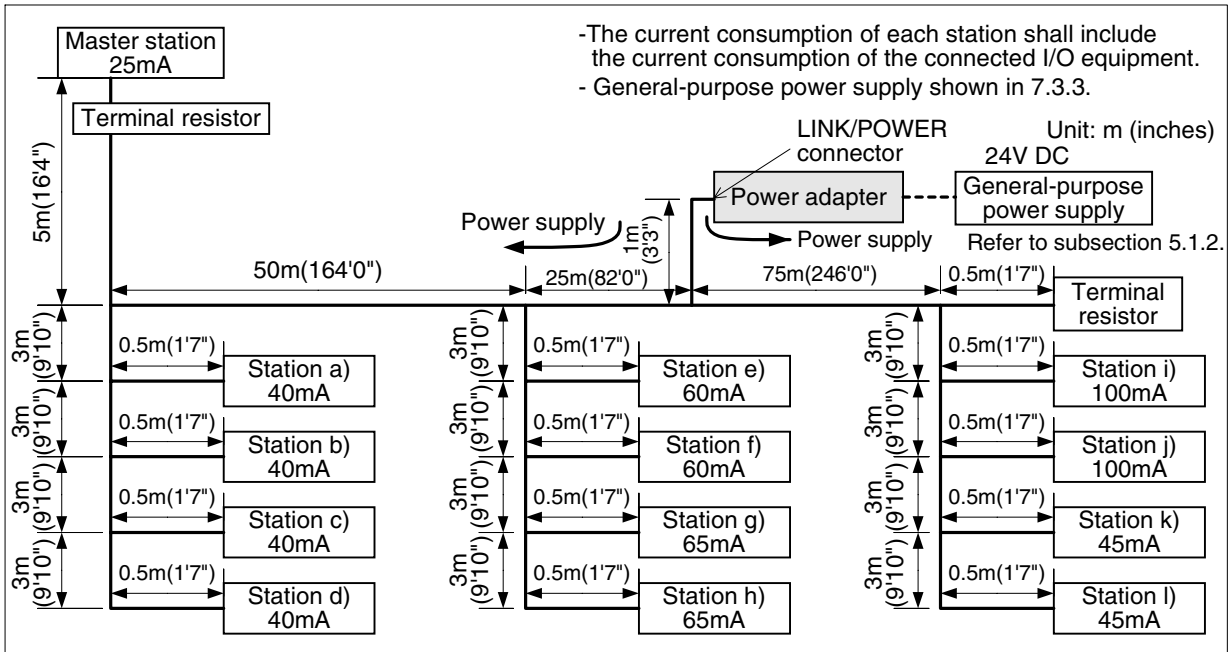
In this example, the maximum allowable distance is as follows.

$$\begin{aligned} \text{Max. distance (m(inches))} &\leq 3.6(\text{V}) \div 0.725(\text{A}) \div 0.06 (\text{constant}) - 11 (\text{constant}) \\ &\leq 71.75862(\text{m})(235'2'') \end{aligned}$$

Accordingly, the power adapter can be connected in such a position that the distance between the power adapter and a remote station or the master station located furthest from the power adapter is approximately less than 71.7 (m) (235' 2").

However, when the maximum distance is long as shown in this example, the system cannot be configured using only one power adapter.

System configuration example



1) Current consumption calculation

Total current consumption

$$\begin{aligned} &25\text{mA} + 40\text{mA} + 40\text{mA} + 40\text{mA} + 40\text{mA} + 60\text{mA} + 60\text{mA} + 65\text{mA} + 65\text{mA} \\ &\text{Master station} \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\ &+ 100\text{mA} + 100\text{mA} + 45\text{mA} + 45\text{mA} = 725\text{mA} = 0.725\text{A} < 5\text{A} \\ &\quad \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)} \end{aligned}$$

2) Voltage drop calculation

$$(88.5\text{m}(290'4'') + \text{Constant: } 11) \times \text{Constant: } 0.06 \times 0.725\text{A} = 4.32825\text{V} > 3.6\text{V}$$

Maximum distance: From the power adapter to the furthest station = Station d)

$$\begin{aligned} &1\text{m}(3'3'') + 75\text{m}(246'0'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') + 0.5\text{m}(1'7'') \\ &= 88.5\text{m}(290'4'') \end{aligned}$$

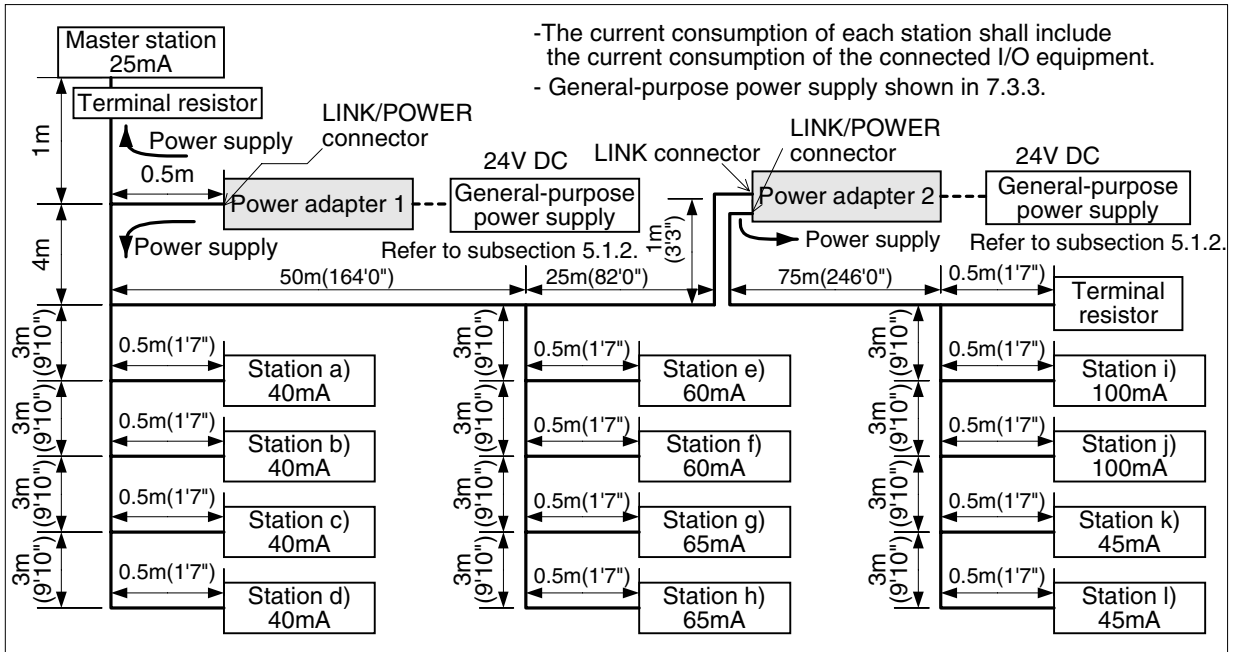
- 3) Confirmation related to the minimum operating voltage (20.4V DC) of the module
 $24V - 4.32825V = 19.67175V < 20.4V$

From 2) and 3) above, the system cannot be supported because the voltage drop is too large.
Add a power adapter as shown in the next page.

7.7.3 Countermeasures (addition of power adapter)

When the minimum operating voltage (20.4 V) for each module connected to the power adapter cannot be satisfied even if the power adapter position is changed as described in 7.7.2, increase the number of power adapters.

System configuration example when two power adapters are used



-The current consumption of each station shall include the current consumption of the connected I/O equipment.
 - General-purpose power supply shown in 7.3.3.

1) Current consumption calculation

Total current consumption in the power adapter 1

$$\begin{aligned}
 & \boxed{25\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{60\text{mA}} + \boxed{60\text{mA}} + \boxed{65\text{mA}} + \boxed{65\text{mA}} \\
 & \text{Master station} \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\
 & = \boxed{435\text{mA}} = \boxed{0.435\text{A}} \leq \boxed{5\text{A}}
 \end{aligned}$$

Total current consumption in the power adapter 2

$$\begin{aligned}
 & \boxed{100\text{mA}} + \boxed{100\text{mA}} + \boxed{45\text{mA}} + \boxed{45\text{mA}} = \boxed{290\text{mA}} = \boxed{0.29\text{A}} \leq \boxed{5\text{A}} \\
 & \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)}
 \end{aligned}$$

2) Voltage drop calculation

Voltage drop in the power adapter 1

$$\boxed{(67\text{m}(219'9'') + \text{Constant:}11)} \times \boxed{\text{Constant: } 0.06} \times \boxed{0.435\text{A}} = \boxed{2.0358\text{V}} \leq \boxed{3.6\text{V}}$$

Maximum distance: From the power adapter to the furthest station = Station h)

$$\begin{aligned}
 & \boxed{0.5\text{m}(1'7'')} + \boxed{4\text{m}(13'1'')} + \boxed{50\text{m}(164'0'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} \\
 & \quad + \boxed{3\text{m}(9'10'')} + \boxed{0.5\text{m}(1'7'')} = \boxed{67\text{m}(219'9'')}
 \end{aligned}$$

Voltage drop in the power adapter 2

$$\boxed{(88.5\text{m}(290'4'') + \text{Constant:}11)} \times \boxed{\text{Constant: } 0.06} \times \boxed{0.29\text{A}} = \boxed{1.7313\text{V}} \leq \boxed{3.6\text{V}}$$

Maximum distance: From the power adapter to the furthest station = Station l)

$$\begin{aligned}
 & \boxed{1\text{m}(3'3'')} + \boxed{75\text{m}(246'0'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{0.5\text{m}(1'7'')} \\
 & = \boxed{88.5\text{m}(290'4'')}
 \end{aligned}$$


- 3) Confirmation related to the minimum operating voltage (20.4V DC) of the module
Power adapter 1: $24V - 2.0358V = 21.9642V \geq 20.4V$
Power adapter 2: $24V - 1.7313V = 22.2687V \geq 20.4V$

From 1), 2) and 3) above, the system can be supported using two power adapters with regard to both the current and voltage restrictions.


MEMO

8. Outline (CL1PSU-2A)

Design precautions


 DANGER

- If a failure occurs in the station the output may switch to the ON or OFF status. For output signals which can lead to a severe accident, install a circuit monitoring device outside the module.

 CAUTION

- Do not bind the control cable or the connection cable together with the main circuit and power cable. Keep such cables far from the main circuit and power cable. Assure a distance of 100mm (3.94") or more, otherwise malfunction may occur due to excessive noise.
- Use the dedicated power supply without applying any force on the connector of the CC-Link/LT interface and the connection cable. Otherwise, such cables may break or fail.

Transportation and maintenance precautions

 CAUTION

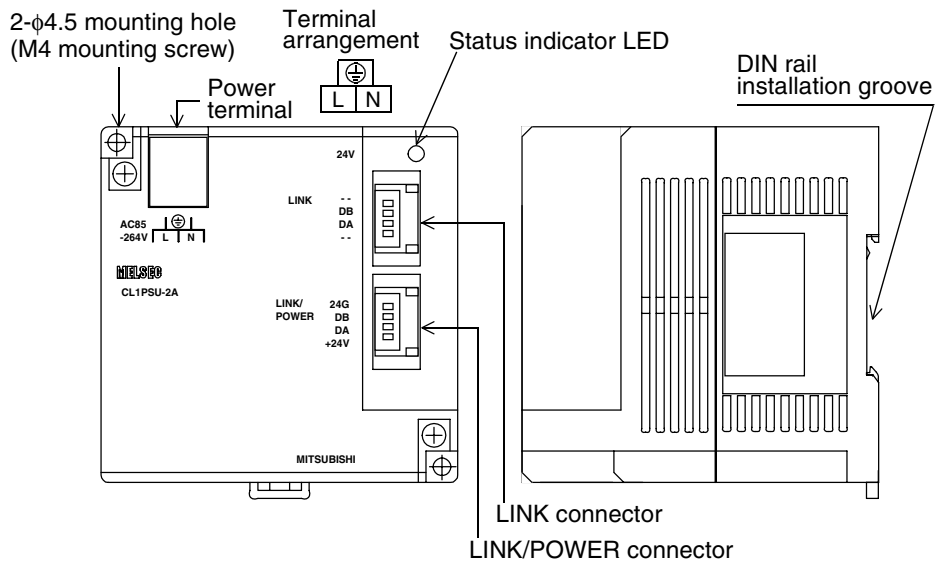
- During transportation avoid the impact which exceeds a regulated value as the dedicated power supply is a precision instrument. It is necessary to check the operation of module after transportation, in case of any impact damage. If not checked, an accident or damage to the machine may result due to a damaged dedicated power supply.

Disposal procedure

 CAUTION

- When disposing of the product, treat it as industrial waste.

8.1 Name of each part and description



Name		Description	
Status indicator LED	24V	Lit while the power is supplied	
Interface	LINK connector	DB	For communication
		DA	For communication
	LINK/ POWER connector	24G	Power supply for communication (-)
		DB	For communication
		DA	For communication
	+24V	Power supply for communication (+)	
Power terminal	L	Supplies power from outside to dedicated power supply. Input voltage: 100,120,200,230,and 240V AC 50/60Hz (Voltage allowable range: 85 to 264V AC)	
	N		
	⊕	Terminal for grounding (100Ω or less)	

9. Specifications (CL1PSU-2A)

9.1 General specifications

Item	Description		
Ambient operating temperature	0 to 55°C (32 to 131°F)		
Ambient storage temperature	-25 to 75°C (-13 to 167°F)		
Ambient operating humidity	5 to 95%RH: Dew condensation shall not be allowed.		
Ambient storage humidity	5 to 95%RH: Dew condensation shall not be allowed.		
Vibration resistance *1	When intermittent vibration is present		Number of sweep times
	Frequency	Acceleration	Half amplitude
	10 to 57Hz	--	0.075mm
	57 to 150Hz	9.8m/s ²	--
	When continuous vibration is present		10 times in each of the X, Y and Z directions (for 80 min)
	Frequency	Acceleration	
10 to 57Hz	--		
	57 to 150Hz	4.9m/s ²	--
Impact resistance *1	147 m/s ² , 3 times in each of X, Y and Z directions		
Operating atmosphere	Corrosive gas shall not be present.		
Operating altitude	2,000m(6561'8") or less *2		
Installation place	Inside control panel		
Over-voltage category	II or less *3		
Degree of contamination	2 or less *4		
Grounding	100Ω or less		

Notes:

*1 The criterion is shown in IEC61131-2.

*2 The module cannot be used in an environment pressurized above atmospheric pressure at the altitude of 0 m. If the module is used in such an environment, it may fail.

*3 This category indicates in which area (inside the site) in relation to the public wiring net the equipment is to be connected.

Category II applies, for example, to equipment whose power is supplied from a fixed facility.

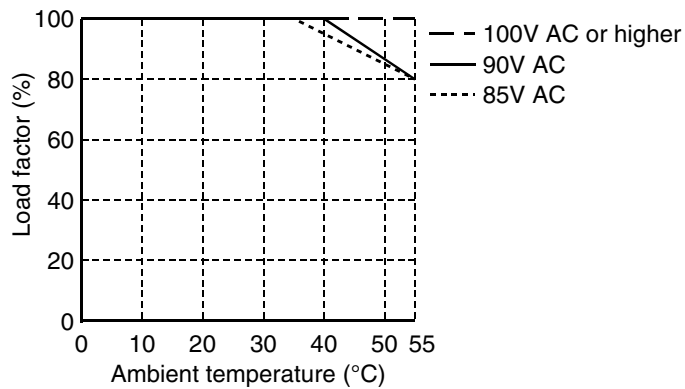
The surge-resistant voltage of equipment whose rating is up to 300V equator to 2,500V.

*4 This index indicates the degree of conductive substances generated in the environment generated in which the module is used. The degree of contamination 2 indicates that contamination is caused by the generation of only non-conductive substances, however, temporary conduction may be caused by accidental condensation.

9.2 Performance specifications

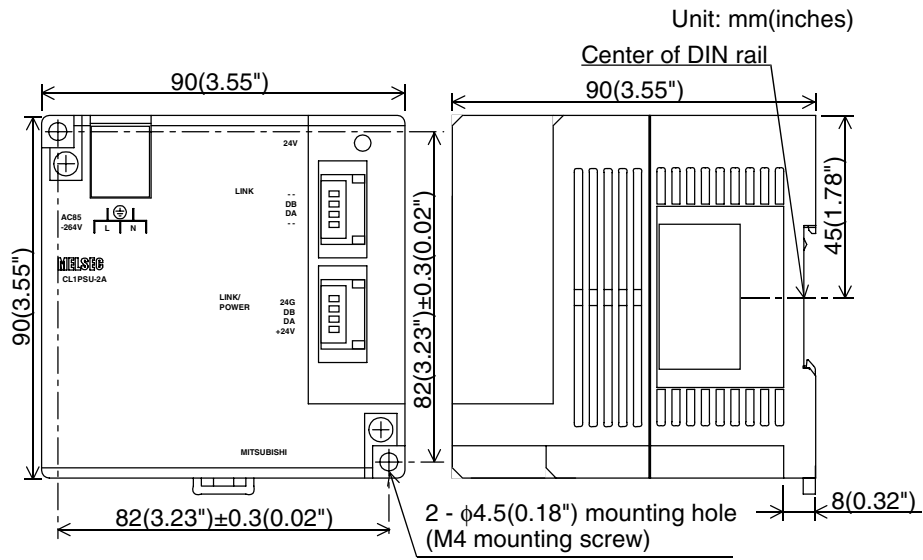
Item		Specification
Input	Rated voltage	100, 120, 200, 230, and 240V AC
	Voltage allowable range	85V to 264V AC
	Rated current	1.2A / 100V AC 0.7A / 200V AC
	Rated frequency	50 or 60Hz
	Power fuse	3.15A
	Inrush current	Max. 50A / 100V AC Max. 60A / 200V AC
Output	Output voltage	24V DC +10 %/-5 %
	Output current	0.01A to 2A Derating occurs according to the ambient temperature and power voltage. [Use the module in a proper range so that the total current consumption of each module does not exceed 2A (except the period immediately after the power is turned on).]
	Ripple noise	500mVp-p or below
Noise resistance		By noise simulator of 1000Vp-p in noise voltage, 1 μ s in noise width, and 25 to 60Hz in frequency
Withstand voltage		AC type 1500V AC for one min. DC type 500V AC for one min.
Allowable momentary power failure time		PS2: Operation continues after power failure for 10ms or less.
Insulation resistance		10 M Ω between the external terminals as a whole and the ground terminal by 500V DC megger
Protection class		IP1X
Protection function	Overvoltage protection	27V to 33V Output interrupt Not automatically reset
	Overcurrent protection	110 to 160% Drooping characteristic Automatically reset
External connection method		<ul style="list-style-type: none"> Supplies power from outside to dedicated power supply: 3 points (M3 screws) on terminal block To communicate and to supply power to CC-Link/LT system: Connector with 4 pins dedicated to CC-Link/LT (2 pcs.)
Mass (Weight)		0.4 kg (0.88 lbs)

Output derating




- The output current that can be used varies depending on the ambient temperature, therefore, refer to the output derating chart above and use the module within its proper range. (When load factor is at 100%, up to 2A current can be output. At 80%, up to 1.6A.)
- When the output current exceeds the specified value, an overcurrent protection circuit drives the output voltage down. When the overcurrent status or short circuit is cleared, the output voltage automatically returns to its normally operating value.
- When an output voltage exceeding the specified value is generated due to some defect inside the power supply, the output is interrupted so that the high voltage will not be output. The protection circuit may also be triggered when a reverse current is generated from the load circuit connected to the output terminal or when an external overvoltage is input. If the overvoltage protection circuit is triggered once, and the output is interrupted and does not return to normal automatically, please have the module checked and/or repaired.

9.3 External Dimensions



10. Installation (CL1PSU-2A)

Installation precautions

 CAUTION

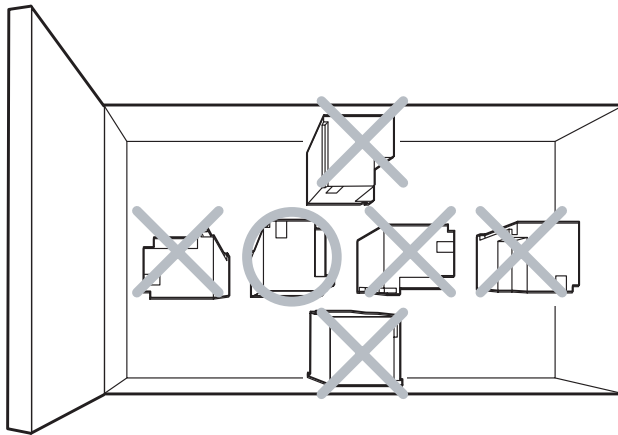
- Use the dedicated power supply in an environment for which the general specifications are described in this manual.
If the power adapter is used in any environment outside the range for the general specifications electrical shock, fire, malfunction, product damage or product deterioration may occur.
- Do not directly touch the conductive area of the dedicated power supply.
Malfunction or damage of the dedicated power supply may be caused by touching the conductive area.
- Securely fix the dedicated power supply on DIN rail or with mounting screws. Securely tighten the mounting screws within the specified torque range (Refer to Subsection 10.1.3).
If the screws are insufficiently tightened, the power adapter may fall, be short-circuited or malfunction.
If the screws are excessively tightened, the screws may be damaged, and the power adapter may fall or be short-circuited.
- Install the dedicated power supply on a flat surface.
If the mounting surface is concave and/or convex, excessive force applied to the PC board may damage the product.
- A Dust-proof sheet is already attached to CL1PSU-2A.
Make sure the sheet is attached during screw hole processing or wiring work to prevent cuttings and wire chips from entering the module through the ventilation slits.
Otherwise, fire, failure, or malfunction may be caused.
- Take off the dust-proof sheet from the ventilation slits of the product after the engineering work.
Otherwise, fire, failure, or malfunction may be caused.

10.1 Installation method

The dedicated power supply can be installed to a DIN rail or directly installed with screws. Provide a space of 50mm (1.97 in.) or more between the dedicated power supply main unit and other equipment or structures. Keep the module as far away from high-voltage cables, high-voltage devices, or power-driven devices as possible. Each installation procedure is described below.

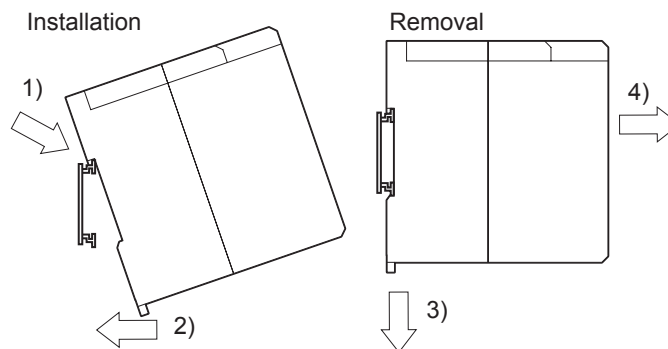
10.1.1 Installation direction

- Do not install the power adapter on the floor surface, ceiling surface or in a horizontal direction. If the power adapter is installed on such a surface or direction, the temperature may rise. Install the power adapter on the wall vertically.



10.1.2 Installation to DIN rail

Align the upper DIN rail installation groove on the power adapter as described in DIN rail 1), and press the power adapter onto the DIN rail as in 2). When removing the power adapter, pull the hook downwards for installation as described in 3), then remove the power adapter 4).



Applicable DIN rail	TH35-7.5Fe and TH35-7.5Al Width: 35mm (1.38")
----------------------------	--

10.1.3 Direct installation

Mount the power adapter by tightening M4 screws to the upper and lower mounting holes (two holes in all) provided on the power adapter.

Applicable screw	M4 height: 16mm(0.63") or more (Tightening torque range: 0.78 to 1.08 N·m)
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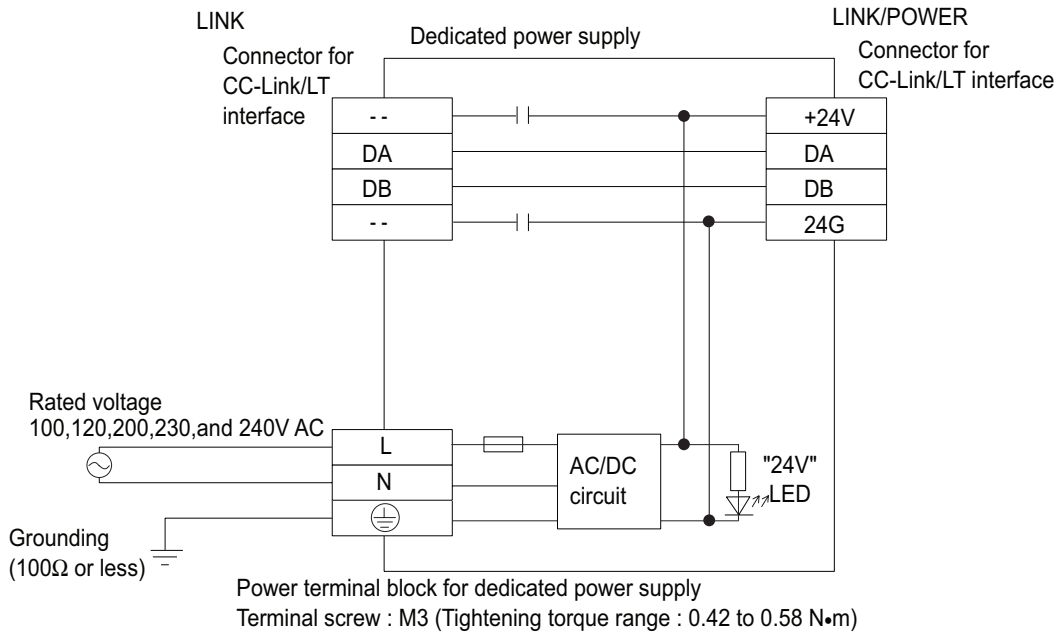
11. Power Wiring (CL1PSU-2A)

Wiring precautions

⚠ DANGER
<ul style="list-style-type: none"> Shut down all external phases of power supply to the module before starting installation or wiring work. If all phases are not shut down, electrical shock or product damage may occur.

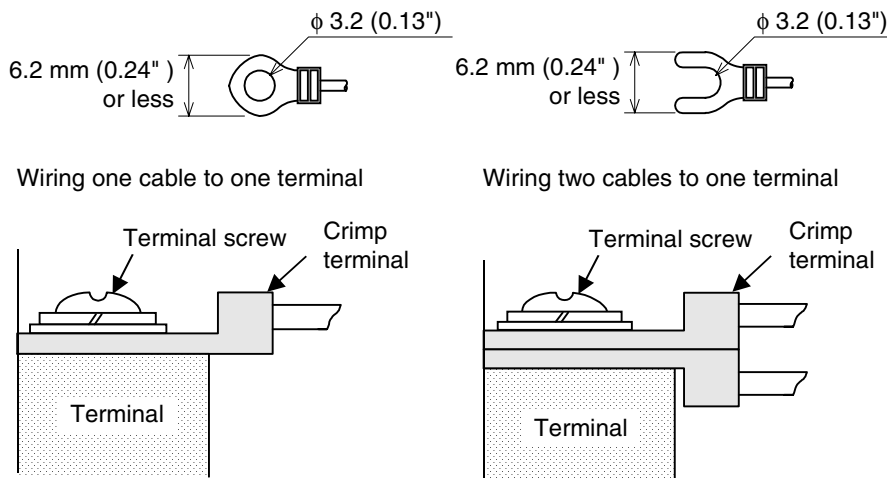
⚠ CAUTION
<ul style="list-style-type: none"> Confirm the rated voltage and the terminal arrangement of the dedicated power supply, then correctly wire the dedicated power supply. If a power supply not conforming to the specified rating is connected or the dedicated power supply is wired incorrectly, fire, failure or malfunction may occur. Tighten the terminal screws within the specified torque range (Refer to Section 11.1). If the terminal screws are insufficiently tightened, fire or malfunction may occur. If the terminal screws are excessively tightened, the screws may be damaged, and the module may short-circuit, equipment failures, or malfunction. Make sure that foreign objects such as cuttings and wire chips do not enter the dedicated power supply. Fire, failure or malfunction may be caused by the foreign objects. When two or more dedicated power supply exist in a system, take care in connecting the first LINK/POWER connector to the second LINK connector as indicated below. If the LINK/POWER connector in the two adapters are connected to each other, the adapters may fail.
<ul style="list-style-type: none"> Do not short-circuit the 24G terminal and the +24V terminal of the LINK/POWER connector. Some remote I/O stations operate the inputs and outputs using the power supply for communication. Refer to the corresponding manuals for remote I/O stations and perform wiring correctly. If wiring is performed incorrectly, fire, failure or malfunction may occur. When the LINK connector is not in use, cover the opening by plugging a connector for communication (without any cable) or attaching a piece of tape to prevent dust or conductive foreign materials from entering the module. Such materials may cause failure or malfunction. Attach a warning label (hazard symbol 417-IEC-5036) concerning electric shock to the enclosure of the final system.

11.1 Power wiring diagram



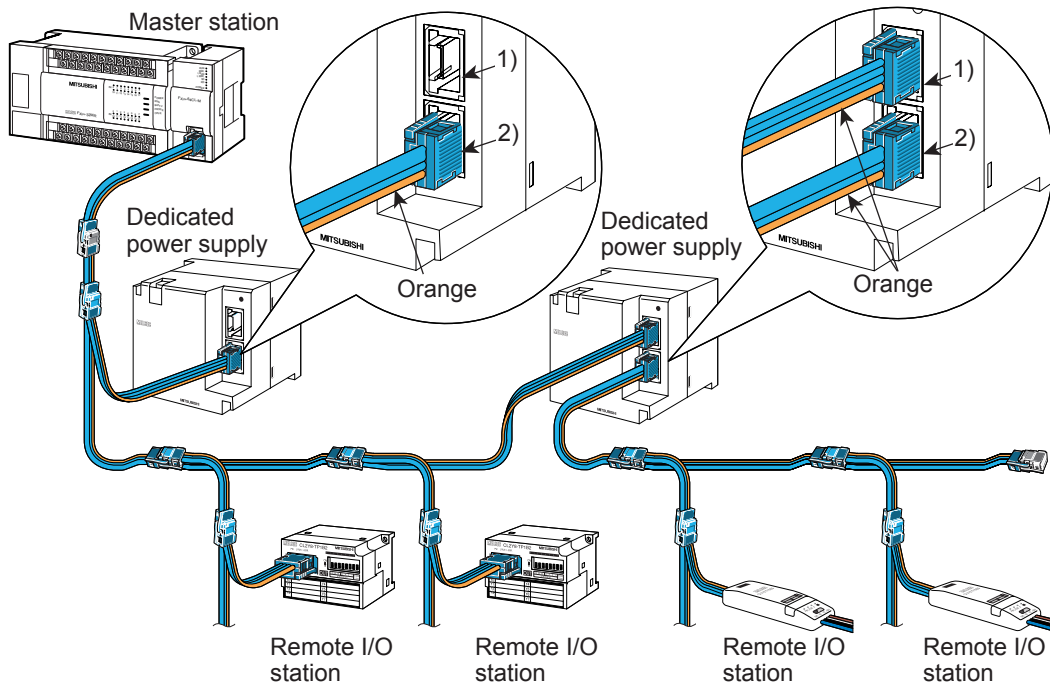
11.2 Crimp-style terminal

For power wiring, use crimp terminals of the following dimensions.



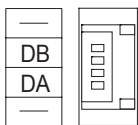
- Use a power wire of 2mm² (0.08in.²) or more.
- Perform grounding (100Ω or less) with a wire of 2 mm² (0.08in.²) or more to the grounding terminal. However, never perform common grounding with a high voltage system.
- Do not tighten terminal screws exceeding the specified torque.
Failure to do so may cause short circuit, equipment failures, or malfunctions.

11.3 Handling of LINK and LINK/POWER connector



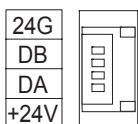
1) LINK connector

Pin assignment Dedicated for communication only (does not supply power).
Used when two or more dedicated power supplies are used in the CC-Link/LT system.



2) LINK/POWER connector

Pin assignment Executes communication and supplies power to the CC-Link/LT system.

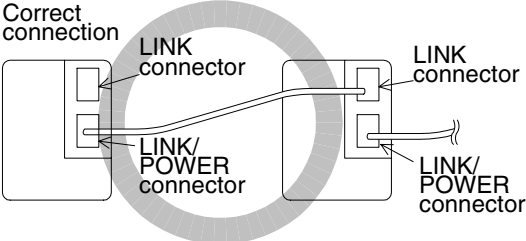


Wiring precautions

⚠ CAUTION

- When two or more dedicated power supplies exist in a system, take care in connecting the first LINK/POWER connector to the second LINK connector as indicated below. If the LINK/POWER connector in the two adapters are connected to each other, the adapters may fail.

Correct connection



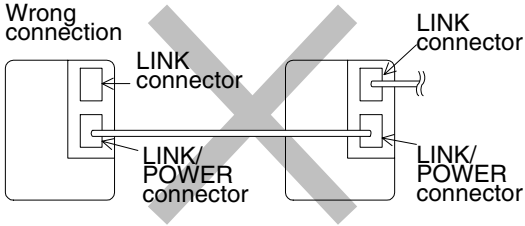
LINK connector

LINK connector

LINK/POWER connector

LINK/POWER connector

Wrong connection



LINK connector

LINK connector


LINK/POWER connector

LINK/POWER connector

- Do not short-circuit the 24G terminal and the +24V terminal of the LINK/POWER connector. Some remote I/O stations operate the inputs and outputs using the power supply for communication. Refer to the corresponding manuals for remote I/O stations and perform wiring correctly.
If wiring is performed incorrectly, fire, failure or malfunction may occur.

12. Cautions on Construction (CL1PSU-2A)

Startup/maintenance precautions

 DANGER

- Do not touch the terminals while the power is supplied.
Electrical shock or malfunction may be caused by touching the terminals.
- Make sure to shut down all external phases of the power supply before cleaning or tightening the terminal screws.
If all phases are not shut down, the dedicated power supply may fail or malfunction.

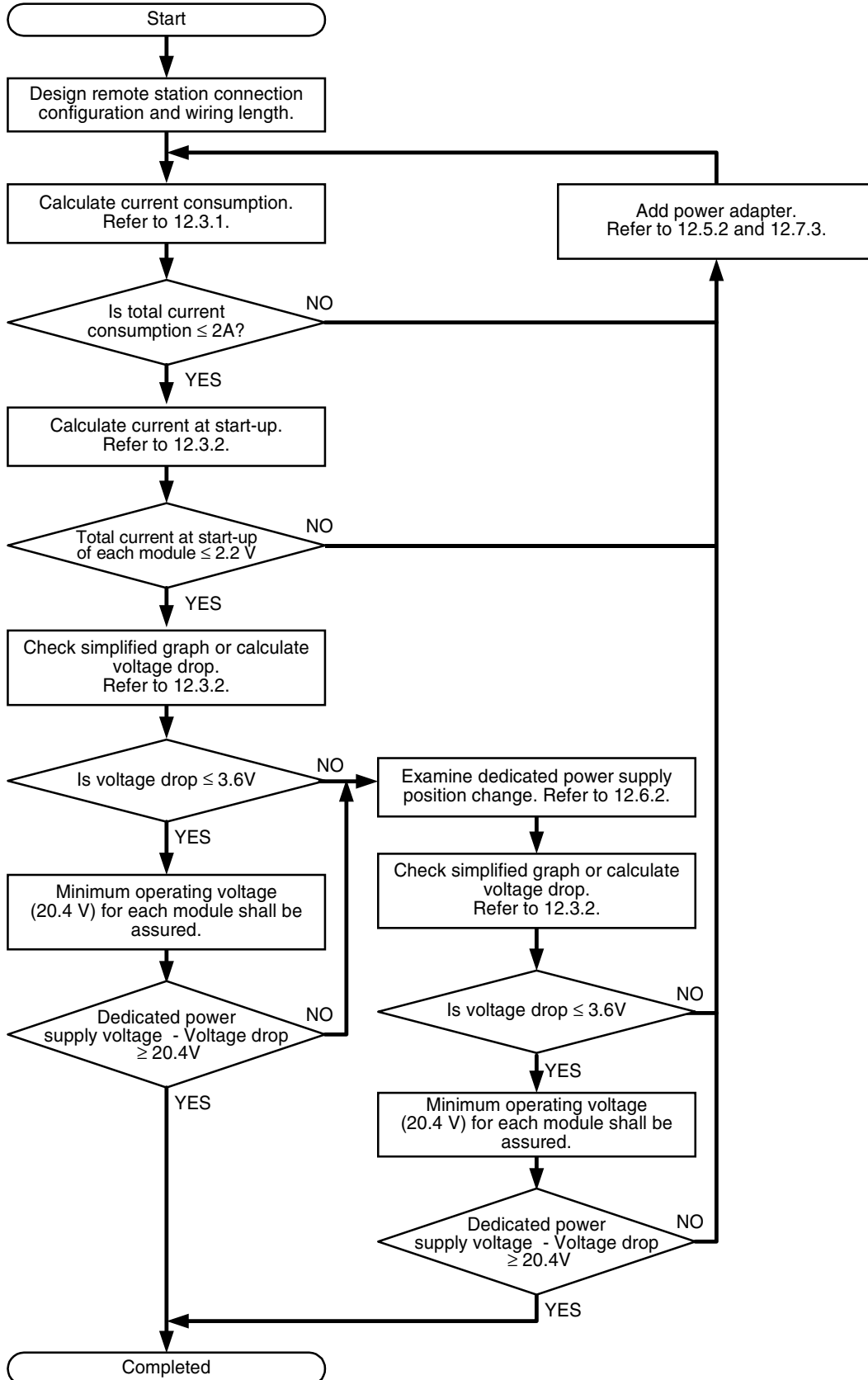
 CAUTION

- Do not disassemble or modify the dedicated power supply.
Failure, malfunction, injury or fire may be caused by any disassembly or modification.
- The dedicated power supply case is made of a resin.
The dedicated power supply may be damaged by dropping or strong impact.
- Shut down all external phases of the power supply before attaching or removing the dedicated power supply to/from the panel.
If all phases are not shut down, the dedicated power supply may fail or malfunction.

12.1 System power calculation procedure

Calculate the system power using the following procedure.

Calculation procedure



12.2 Installation concept of dedicated power supplies

12.2.1 Number of dedicated power supplies

When constructing the system using only one dedicated power supply, the following four conditions should be satisfied.

If the following three conditions are not satisfied, the use of four or more dedicated power supplies should be considered constructing the system.

- 1) Because the current capacity of the dedicated power supply is 2A, the total current consumption of remote stations, I/O equipment and the master station receiving power from dedicated power supply $\leq 2A$.
- 2) Total current at start-up of each module + current consumption in the I/O equipment that receives power from a dedicated power supply \leq Maximum output current (2.2A) of dedicated power supply
- 3) To operate the system in a stable environment, the voltage drop should be equivalent to or less than 3.6V.
- 4) As the minimum operating voltage from the dedicated power supply is 20.4V for each remote module, Supply voltage to dedicated power supply - Voltage drop $\geq 20.4V$.

There is a formula (Refer to section 12.3.) to test the system configuration with regard to the voltage drop of the cable.

If the total current consumption or the voltage drop due to the cable is too large, take the following countermeasures.

When the total current consumption or current at start-up is large

- Add power adapters or dedicated power supplies.
(Use several power adapters or dedicated power supplies so that the power supplied to the system is divided accordingly.)

When the voltage drop is large or the minimum operating voltage (20.4V DC) of each station is not assured

- Change the dedicated power supply position.
(Shorten the maximum distance from the dedicated power supply to a remote station or the master station.)
- Shorten the connection cable.
(Shorten the maximum distance from the dedicated power supply to a remote station or the master station.)
- Add power adapters or dedicated power supplies.
(Use several power adapters or dedicated power supplies so that the power supplied to the system is divided accordingly.)

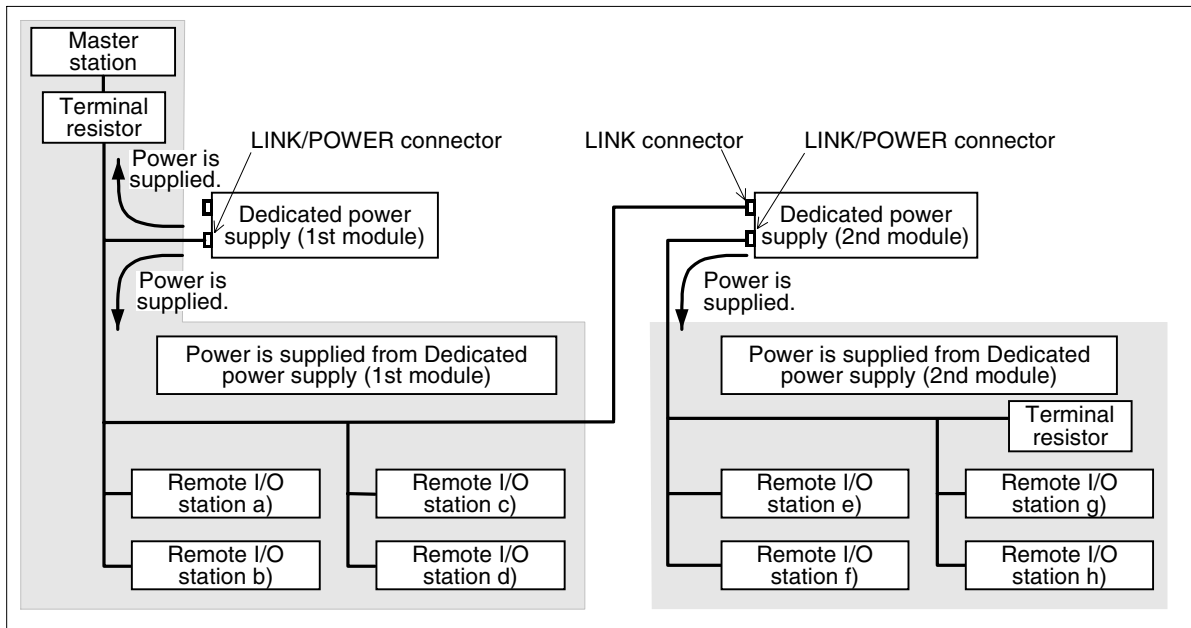
12.2.2 Rule when using two or more dedicated power supplies

Two or more dedicated power supplies can be used in a system.

(A power adapter and a dedicated power supply can be used concurrently.)

When using two or more dedicated power supply units, calculate the 'Current consumption', 'Current at start-up', 'Voltage drop', and 'Minimum operating voltage (20.4V DC)' for each power adapter and construct the system so that each condition is satisfied.

System configuration example



1) Current consumption calculation

Current consumption calculation in dedicated power supply (1st module)	=	Total current consumption in master station and remote I/O station a) to d) *1
--	---	--

Current consumption calculation in dedicated power supply (2nd module)	=	Total current consumption in remote I/O station e) to h) *1
--	---	---

2) Start-up current calculation

Start-up current calculation supplied from dedicated power supply (1st module)	=	Total current of master station and remote I/O station a) to d) at start-up *1
--	---	--

Start-up current calculation supplied from dedicated power supply (2nd module)	=	Total current of remote I/O station e) to h) at start-up *1
--	---	---

3) Voltage drop calculation

Voltage drop calculation supplied from dedicated power supply (1st module)	=	Calculate voltage drop in master station and remote I/O station a) to d) based on current consumption and distance to the furthest station.
--	---	---

Voltage drop calculation supplied from dedicated power supply (2nd module)	=	Calculate voltage drop in remote I/O station e) to h) based on current consumption and distance to the furthest station.
--	---	--

4) Confirmation related to the minimum operating voltage (20.4V DC) of the module

Minimum operating voltage (20.4V DC) from dedicated power supply (1st module)
--

=

Output voltage of dedicated power supply (1st module) -voltage drop \geq 20.4V

Minimum operating voltage (20.4V DC) from dedicated power supply (2nd module)
--

=

Output voltage of dedicated power supply (2nd module) -voltage drop \geq 20.4V

*1 If a remote I/O module supplies power to the connected I/O equipment, the current consumption in the I/O equipment also needs to be included in the calculation.

12.3 System power calculation method

12.3.1 Current consumption calculation

Using the formula below, calculate the total current consumption of the remote stations, I/O equipment and the master station receiving power from the dedicated power supply.

$$\boxed{\begin{array}{c} \text{Current consumption in} \\ \text{CC-Link/LT} \\ \text{system} \end{array}} = \boxed{\begin{array}{c} \text{Total current consumption of} \\ \text{each module in} \\ \text{CC-Link/LT system} \end{array}} + \boxed{\begin{array}{c} \text{Total current consumption of I/O} \\ \text{equipment (such as sensors)} \\ \text{(to which power is supplied via} \\ \text{communication cable)*1} \end{array}} \leq 2A$$

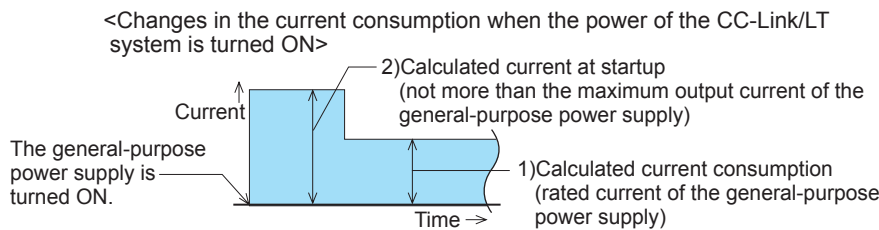
Notes:

*1 Some remote I/O stations for CC-Link/LT supply the power for I/O via a connection cable. For details, refer to the instruction manual of each remote I/O station.

12.3.2 Start-up current calculation

Construct the system properly so that the calculated start-up current (when the power is turned on) does not exceed the maximum output current (2.2 A) of the dedicated power supply.

$$\boxed{\begin{array}{c} \text{Total current at} \\ \text{start-up of each} \\ \text{module of} \\ \text{CC-Link/LT} \end{array}} + \boxed{\begin{array}{c} \text{Total current consumption of I/O} \\ \text{equipment (such as sensors)} \\ \text{(to which power is supplied via a} \\ \text{connection cable)} \end{array}} \leq \boxed{\begin{array}{c} \text{Maximum output} \\ \text{current (2.2 A) of} \\ \text{dedicated power} \\ \text{supply} \end{array}}$$



12.3.3 Voltage drop

The voltage drop can be calculated using the "1) Simplified graph" or "2) Calculation formula". The voltage drop is in proportion to the length of the connection cable and the current consumption of a connected master station, remote stations, or I/O equipment.

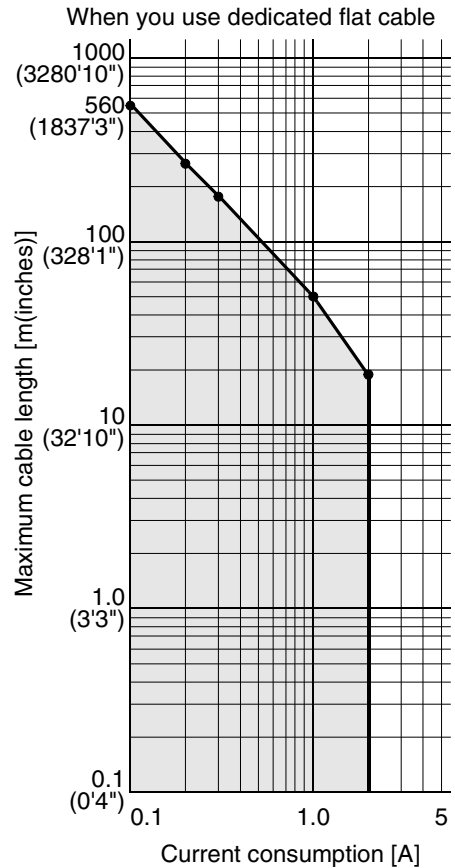
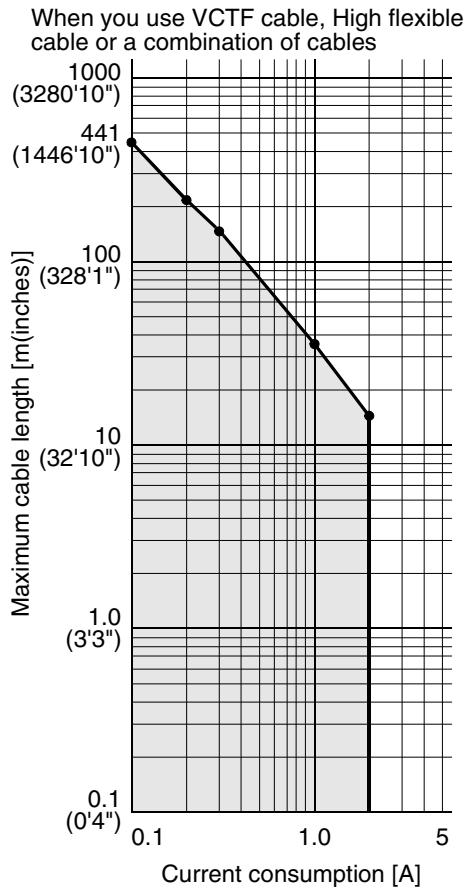
Calculate the voltage drop with respect to the cable length up to a remote station or the master station that is located furthest from the dedicated power supply.

- 1) Selection based on the simplified graph
(at supply voltage: 100V AC, ambient temperature: 20°C)

The graph on the right shows the relationship between current consumption (A) and the cable length (m(inches)) that causes a voltage drop of 3.6 V.

If the relationship between the current consumption and the cable length is within the shaded range of the graph, a system can be configured using only one dedicated power supply.

However, the available main line length, branch line length and total branch line length are restricted by transmission speed.



- Maximum cable length:
Cable length between the dedicated power supply and a remote station or the master station located furthest from the dedicated power supply

2) Selection based on the calculation formula
 (at supply voltage: 100V AC, ambient temperature: 20°C)

- When you use VCTF cable, High flexible cable or a combination of cables

$$\boxed{\text{Voltage drop (V)}} = \boxed{\text{Maximum distance (m) + Constant: 9}} \times \boxed{\text{Constant : 0.08}} \times \boxed{\text{Total current consumption (A)}} \leq 3.6V$$

- When you use dedicated flat cable

$$\boxed{\text{Voltage drop (V)}} = \boxed{\text{Maximum distance (m) + Constant: 11}} \times \boxed{\text{Constant : 0.06}} \times \boxed{\text{Total current consumption (A)}} \leq 3.6V$$

Maximum distance	Distance from dedicated power supply, to the furthest station receiving power from the dedicated power supply in question. A station that is powered by another dedicated power supply further along the network should not be considered.	
Total current consumption	Total current consumption of each unit within the CC-Link/LT system receiving power from the dedicated power supply in question. A station that is powered by another dedicated power supply further along the network should not be considered.	+ Total current consumption of the I/O equipment (such as sensors to which power is supplied via a connection cable *1) connected to each unit within the CC-Link/LT system receiving power from the dedicated power supply in question. A station that is powered by another dedicated power supply further along the network should not be considered.

*1 Some remote I/O stations for CC-Link/LT supply the power for I/O via a connection cable. For the details, refer to the instruction manual of each remote I/O station.

When the current consumption is determined, the distance from the dedicated power supply to the furthest station can be obtained from the following formula.

- When you use VCTF cable, High flexible cable or a combination of cables

$$\boxed{\text{Maximum distance (m)}} \leq 3.6V \div \boxed{\text{Total current consumption (A)}} \div \boxed{0.08 \text{ (Constant)}} - \boxed{9 \text{ (Constant)}}$$

- When you use dedicated flat cable

$$\boxed{\text{Maximum distance (m)}} \leq 3.6V \div \boxed{\text{Total current consumption (A)}} \div \boxed{0.06 \text{ (Constant)}} - \boxed{11 \text{ (Constant)}}$$

Or when the distance from the dedicated power supply to the furthest station is determined, the allowable current consumption can be obtained from the formula below.

- When you use VCTF cable, High flexible cable or a combination of cables

$$\boxed{\text{Total current consumption (A)}} \leq 3.6V \div \boxed{0.08 \text{ (Constant)}} \div \boxed{\text{Maximum distance (m) + 9 (Constant)}}$$

- When you use dedicated flat cable

$$\boxed{\text{Total current consumption (A)}} \leq 3.6V \div \boxed{0.06 \text{ (Constant)}} \div \boxed{\text{Maximum distance (m) + 11 (Constant)}}$$

The simplified graph and the calculation formula for voltage drop may not always be accurate as effects such as ambient temperature and the number of connectors used can influence the results.

If the conditions of "12.2 Installation concept of dedicated power supplies" are not satisfied, more than one dedicated power supply should be considered when constructing the system.

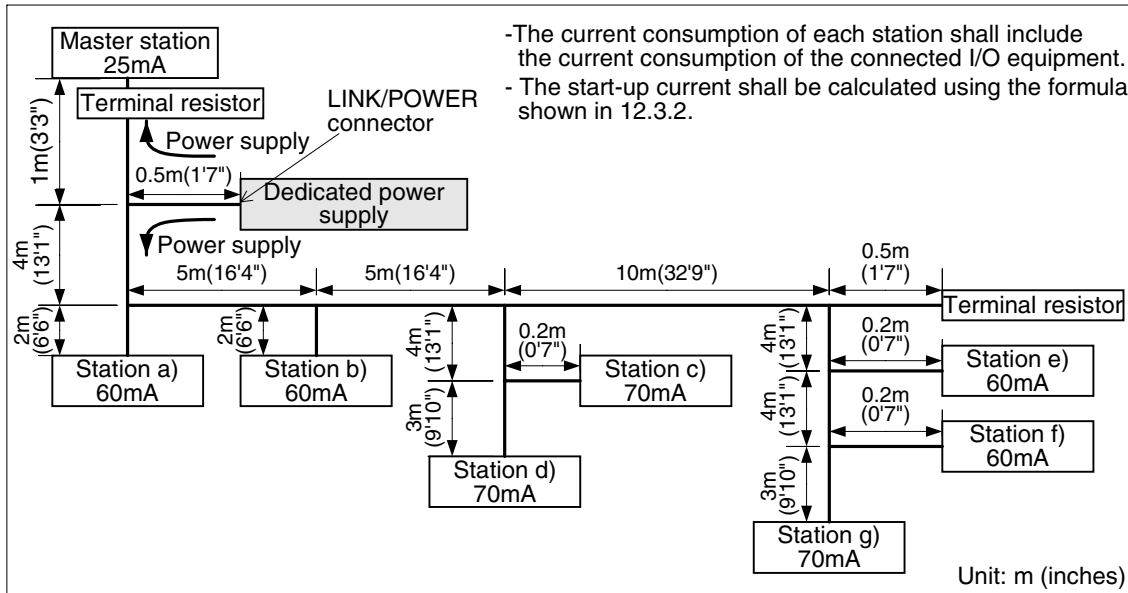
And if the driving voltage (20.4 V) cannot be assured in a remote station, take proper countermeasures. (Refer to 12.1.)

$$\boxed{\begin{array}{l} \text{Output voltage} \\ \text{of dedicated} \\ \text{power supply} \end{array}} - \boxed{\text{Voltage drop}} \geq 20.4\text{V}$$

12.4 System configuration example 1

This section describes a configuration example when both the current consumption and the voltage drop are minimal.

System configuration example



1) Current consumption calculation

Total current consumption

$$25\text{mA} + 60\text{mA} + 60\text{mA} + 70\text{mA} + 70\text{mA} + 60\text{mA} + 60\text{mA} + 70\text{mA} = 475\text{mA} = 0.475\text{A} \leq 2\text{A}$$

Master station Station a) Station b) Station c) Station d) Station e) Station f) Station g)

2) Voltage drop calculation

$$(35.5\text{m}(116'5'') + \text{Constant: } 11) \times \text{Constant: } 0.06 \times 0.475\text{A} = 1.32525\text{V} \leq 3.6\text{V}$$

Maximum distance:

From the dedicated power supply to the farthest station = Station g) in the branch line D

$$0.5\text{m}(1'7'') + 4\text{m}(13'1'') + 5\text{m}(16'4'') + 5\text{m}(16'4'') + 10\text{m}(32'9'') + 4\text{m}(13'1'') + 4\text{m}(13'1'') + 3\text{m}(9'10'') = 35.5\text{m}(116'5'')$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

$$24\text{V} - 1.32525\text{V} = 22.67475\text{V} \geq 20.4\text{V}$$

From 1), 2) and 3) above, the system can be configured using only one dedicated power supply with regard to both the current and voltage restrictions.

12.5 System configuration example 2 (when current consumption is large)

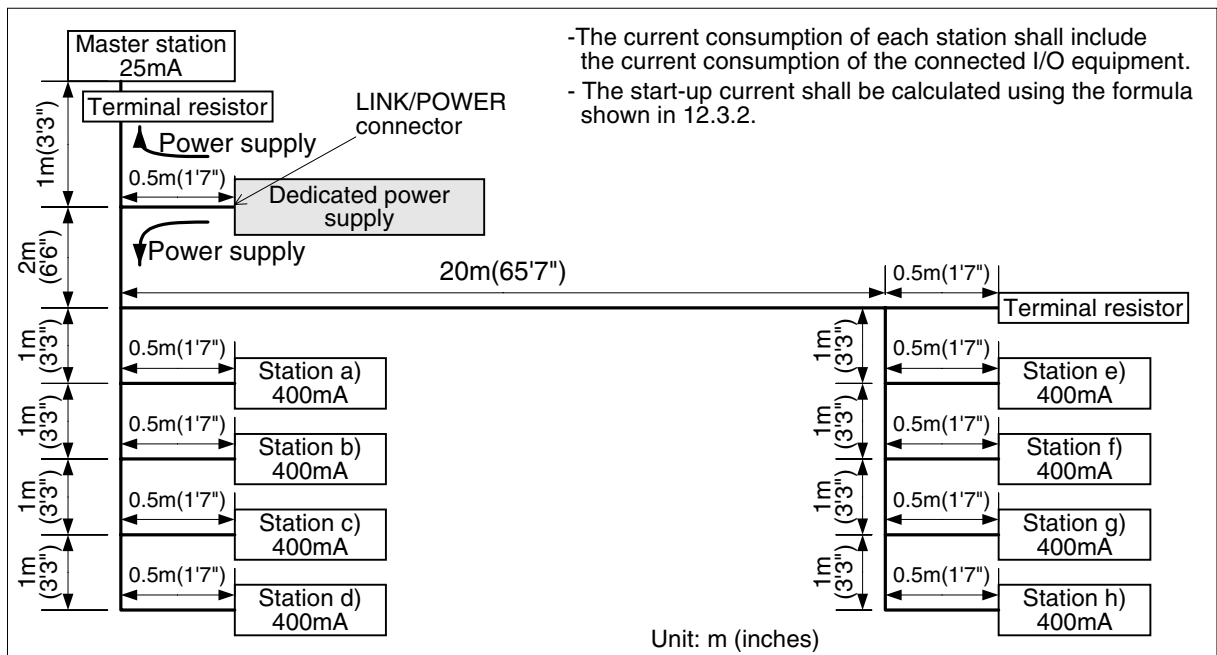
This section describes a configuration example and countermeasures needed in the case when the current consumption is too large.

When the current consumption is large, increase the number of dedicated power supplies without regard to the voltage drop value so that the total current consumption of the modules connected to each dedicated power supply is 2 A or less.

12.5.1 System configuration example having large current consumption

In the system configuration example shown below, the total current consumption of the connected modules exceeds 2 A.

System configuration example



1) Current consumption calculation

Total current consumption

$$25\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} = 3225\text{mA} = 3.225\text{A} > 2\text{A}$$

Master station Station a) Station b) Station c) Station d) Station e) Station f) Station g) Station h)

2) Voltage drop calculation

$$(27\text{m}(88'6'') + \text{Constant: } 11) \times \text{Constant: } 0.06 \times 3.225\text{A} = 7.353\text{V} > 3.6\text{V}$$

Maximum distance: From the dedicated power supply to the furthest station = Station h)

$$0.5\text{m}(1'7'') + 2\text{m}(6'6'') + 20\text{m}(65'7'') + 1\text{m}(3'3'') + 1\text{m}(3'3'') + 1\text{m}(3'3'') + 1\text{m}(3'3'') + 0.5\text{m}(1'7'') = 27\text{m}(88'6'')$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

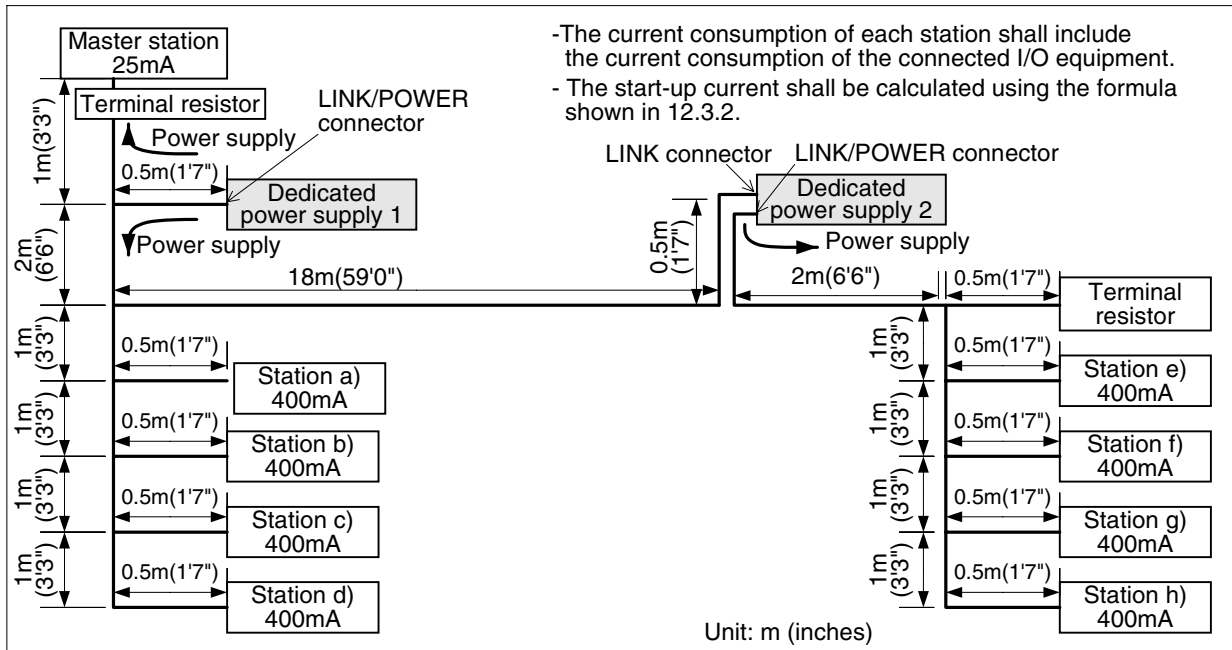
$$24\text{V} - 7.353\text{V} = 16.647\text{V} < 20.4\text{V}$$

From 1), 2) and 3) above, the system cannot be configured using only one dedicated power supply with regard to both the current and voltage restrictions. Add a dedicated power supply as shown in the next page.

12.5.2 Countermeasures (addition of dedicated power supply)

When the current consumption exceeds 2 A, add dedicated power supplies in constructing the system so that the total current consumption of modules connected to each dedicated power supply is 2 A or less.

System configuration example when two dedicated power supplies are used



1) Current consumption calculation

Total current consumption in the dedicated power supply 1

$$25\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} = 1625\text{mA} = 1.625\text{A} \leq 2\text{A}$$

Master station Station a) Station b) Station c) Station d)

Total current consumption in the dedicated power supply 2

$$400\text{mA} + 400\text{mA} + 400\text{mA} + 400\text{mA} = 1600\text{mA} = 1.6\text{A} \leq 2\text{A}$$

Station e) Station f) Station g) Station h)

2) Voltage drop calculation

Voltage drop in the dedicated power supply 1

$$(7\text{m}(22'11\text{")}) + \text{Constant:}11) \times \text{Constant:} 0.06 \times 1.625\text{A} = 1.755\text{V} \leq 3.6\text{V}$$

Maximum distance: From the dedicated power supply to the furthest station = Station d)

$$0.5\text{m}(1'7\text{")}) + 2\text{m}(6'6\text{")}) + 1\text{m}(3'3\text{")}) + 1\text{m}(3'3\text{")}) + 1\text{m}(3'3\text{")}) + 1\text{m}(3'3\text{")}) + 0.5\text{m}(1'7\text{")}) = 7\text{m}(22'11\text{")})$$

Voltage drop in the dedicated power supply 2

$$(7\text{m}(22'11\text{")}) + \text{Constant:}11) \times \text{Constant:} 0.06 \times 1.6\text{A} = 1.728\text{V} \leq 3.6\text{V}$$

Maximum distance: From the dedicated power supply to the furthest station = Station h)

$$0.5\text{m}(1'7\text{")}) + 2\text{m}(6'6\text{")}) + 1\text{m}(3'3\text{")}) + 1\text{m}(3'3\text{")}) + 1\text{m}(3'3\text{")}) + 1\text{m}(3'3\text{")}) + 0.5\text{m}(1'7\text{")}) = 7\text{m}(22'11\text{")})$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

Dedicated power supply 1: $24\text{V} - 1.755\text{V} = 22.245\text{V} \geq 20.4\text{V}$

Dedicated power supply 2: $24\text{V} - 1.728\text{V} = 22.272\text{V} \geq 20.4\text{V}$

From 1), 2) and 3) above, the system can be configured using two dedicated power supplies with regard to both the current and voltage restrictions.

12.6.2 Countermeasures (changing the dedicated power supply position)

When the current consumption is determined, the maximum allowable distance can be obtained using the following formula.

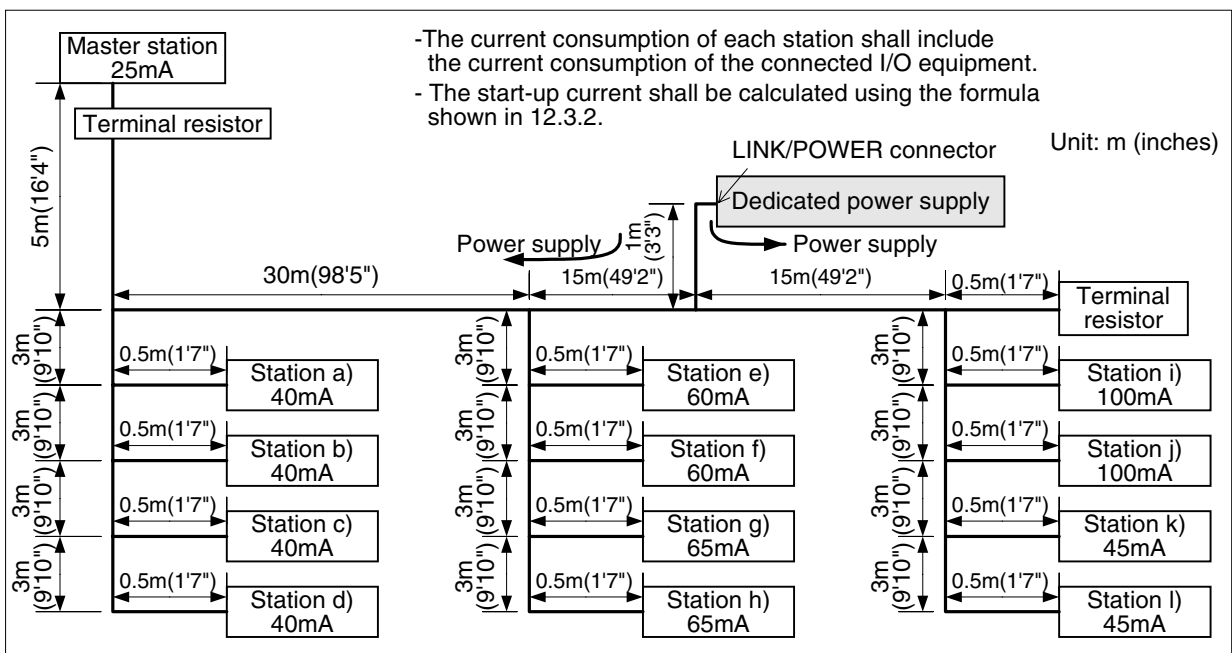
$$\text{Max. distance (m(inches))} \leq \frac{3.6(\text{V})}{\text{Total current consumption (A)}} \div 0.06 (\text{constant}) - 11 (\text{constant})$$

In this example, the maximum allowable distance is as follows.

$$\begin{aligned} \text{Max. distance (m(inches))} &\leq \frac{3.6(\text{V})}{0.725(\text{A})} \div 0.06 (\text{constant}) - 11 (\text{constant}) \\ &\leq 71.75862(\text{m})(235'2'') \end{aligned}$$

Accordingly, the dedicated power supply can be connected in such a position that the distance between the dedicated power supply and a remote station or the master station located furthest from the dedicated power supply is approximately less than 71.7 (m) (235' 2").

System configuration example when the dedicated power supply position is changed.



1) Current consumption calculation

Total current consumption

$$\begin{aligned} &25\text{mA} + 35\text{mA} + 35\text{mA} + 40\text{mA} + 40\text{mA} + 60\text{mA} + 60\text{mA} + 65\text{mA} + 65\text{mA} \\ &\text{Master station} \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\ &+ 100\text{mA} + 100\text{mA} + 45\text{mA} + 45\text{mA} = 725\text{mA} = 0.725\text{A} < 2\text{A} \\ &\quad \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)} \end{aligned}$$

2) Voltage drop calculation

$$(58.5\text{m}(191'11'') + \text{Constant:}11) \times \text{Constant:} 0.06 \times 0.725\text{A} = 3.0325\text{V} \leq 3.6\text{V}$$

Maximum distance: From the dedicated power supply to the furthest station = Station d)

$$\begin{aligned} &1\text{m}(3'3'') + 15\text{m}(49'2'') + 30\text{m}(98'5'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') + 3\text{m}(9'10'') \\ &+ 0.5\text{m}(1'7'') = 58.5\text{m}(191'11'') \end{aligned}$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

$$24\text{V} - 3.02325\text{V} = 20.97675\text{V} \geq 20.4\text{V}$$

From 1), 2) and 3) above, the system can be configured using only one dedicated power supply with regard to both the current and voltage restrictions.

12.7 System configuration example 4 (when the voltage drop is large)

This section describes a configuration example and countermeasures needed in the case when the voltage drop is large, and the minimum operating voltage (20.4 V) for each module connected to the dedicated power supply cannot be satisfied even if the dedicated power supply position is changed.

When the voltage drop is large, change the voltage drop position as described in "12.6 System configuration example 3". However, in some conditions, the minimum operating voltage (20.4 V) for each module connected to the dedicated power supply cannot be satisfied even if the dedicated power supply position is changed.

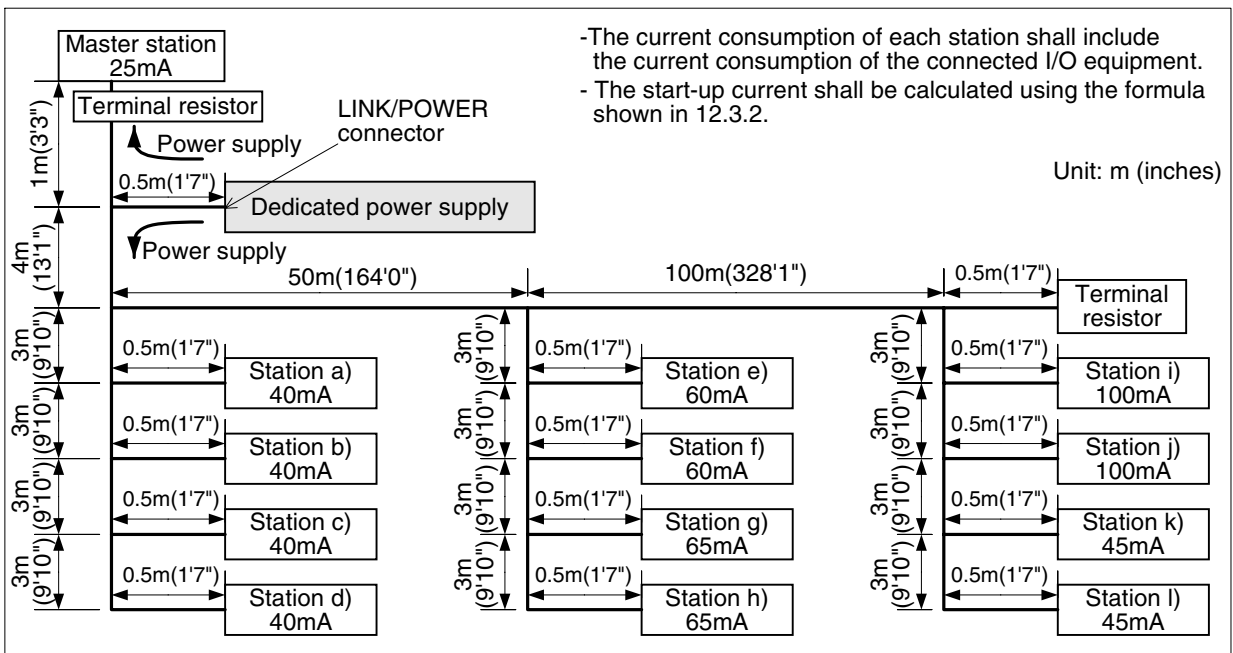
Therefore, increase the number of dedicated power supplies so that the minimum operating voltage (20.4 V) for each module is satisfied.

Also when the current consumption is too large, increase the number of dedicated power supplies. (Refer to 12.5.)

12.7.1 System configuration example 1 disabling operation

In the system configuration example shown below, some modules cannot operate normally because the voltage drop is large.

System configuration example



1) Current consumption calculation

Total current consumption

$$\begin{aligned}
 & \boxed{25\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{60\text{mA}} + \boxed{60\text{mA}} + \boxed{65\text{mA}} + \boxed{65\text{mA}} \\
 & \text{Master station} \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\
 & + \boxed{100\text{mA}} + \boxed{100\text{mA}} + \boxed{45\text{mA}} + \boxed{45\text{mA}} = \boxed{725\text{mA}} = \boxed{0.725\text{A}} < \boxed{2\text{A}} \\
 & \quad \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)}
 \end{aligned}$$

2) Voltage drop calculation

$$(167\text{m}(547'10") + \text{Constant:}11) \times \text{Constant: } 0.06 \times 0.725\text{A} = 7.743\text{V} > 3.6\text{V}$$

Maximum distance: From the dedicated power supply to the furthest station = Station I)

$$\begin{aligned} &0.5\text{m}(1'7") + 4\text{m}(13'1") + 50\text{m}(164'0") + 100\text{m}(328'1") + 3\text{m}(9'10") + 3\text{m}(9'10") \\ &+ 3\text{m}(9'10") + 3\text{m}(9'10") + 0.5\text{m}(1'7") = 167\text{m}(547'10") \end{aligned}$$

3) Confirmation related to the minimum operating voltage (20.4V DC) of the module

$$24\text{V} - 7.743\text{V} = 16.257\text{V} < 20.4\text{V}$$

From 2) and 3) above, the system cannot be supported because the voltage drop is too large. Add a dedicated power supply as described in 12.7.3. The fact that the system cannot be supported in this example even if the dedicated power supply position is changed is described in the next page.

12.7.2 System configuration example 2 disabling operation (even if dedicated power supply position is changed)

When the current consumption is determined, the maximum allowable distance can be obtained using the following formula.

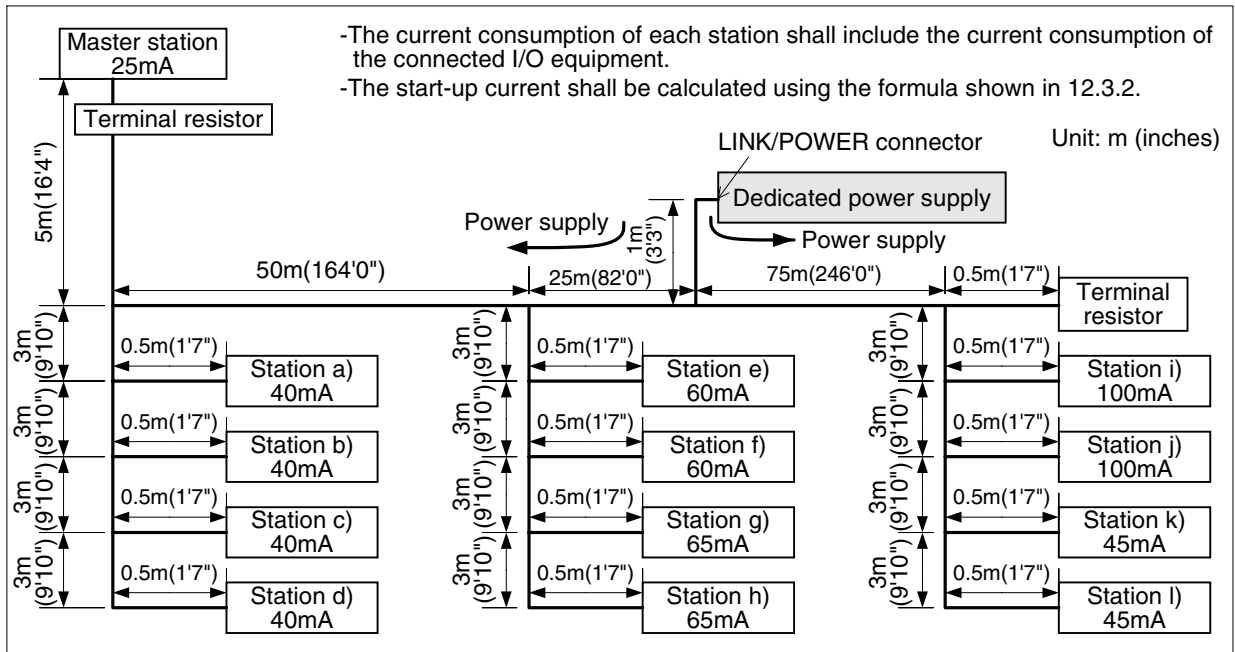
$$\text{Max. distance (m(inches))} \leq \frac{3.6(\text{V})}{\text{Total current consumption (A)}} \div 0.06 (\text{constant}) - 11 (\text{constant})$$

In this example, the maximum allowable distance is as follows.

$$\begin{aligned} \text{Max. distance (m(inches))} &\leq \frac{3.6(\text{V})}{0.725(\text{A})} \div 0.06 (\text{constant}) - 11 (\text{constant}) \\ &\leq 71.75862(\text{m})(235'2") \end{aligned}$$

Accordingly, the dedicated power supply can be connected in such a position that the distance between the dedicated power supply and a remote station or the master station located furthest from the dedicated power supply is approximately less than 71.7 (m) (235' 2"). However, when the maximum distance is long as shown in this example, the system cannot be configured using only one dedicated power supply.

System configuration example



1) Current consumption calculation

Total current consumption

$$\begin{aligned} &25\text{mA} + 40\text{mA} + 40\text{mA} + 40\text{mA} + 40\text{mA} + 60\text{mA} + 60\text{mA} + 65\text{mA} + 65\text{mA} \\ &\text{Master station} \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\ &+ 100\text{mA} + 100\text{mA} + 45\text{mA} + 45\text{mA} = 725\text{mA} = 0.725\text{A} < 2\text{A} \\ &\quad \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)} \end{aligned}$$

2) Voltage drop calculation

$$(88.5\text{m}(290'4") + \text{Constant: } 11) \times \text{Constant: } 0.06 \times 0.725\text{A} = 4.32825\text{V} > 3.6\text{V}$$

Maximum distance: From the dedicated power supply to the furthest station = Station d)

$$\begin{aligned} &1\text{m}(3'3") + 75\text{m}(246'0") + 3\text{m}(9'10") + 3\text{m}(9'10") + 3\text{m}(9'10") + 3\text{m}(9'10") + 0.5\text{m}(1'7") \\ &= 88.5\text{m}(290'4") \end{aligned}$$

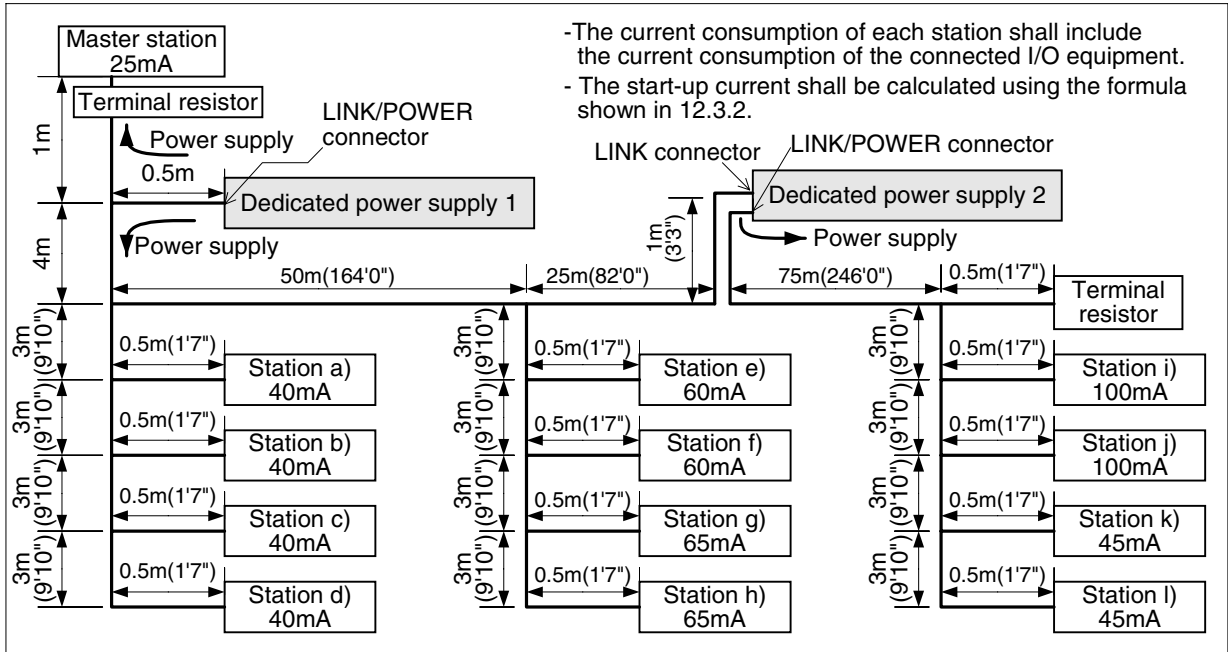
- 3) Confirmation related to the minimum operating voltage (20.4V DC) of the module
 $24V - 4.32825V = 19.67175V < 20.4V$

From 2) and 3) above, the system cannot be supported because the voltage drop is too large.
Add a dedicated power supply as shown in the next page.

12.7.3 Countermeasures (addition of dedicated power supply)

When the minimum operating voltage (20.4 V) for each module connected to the dedicated power supply cannot be satisfied even if the dedicated power supply position is changed as described in 12.7.2, increase the number of dedicated power supplies.

System configuration example when two dedicated power supplies are used



1) Current consumption calculation

Total current consumption in the dedicated power supply 1

$$\begin{aligned}
 & \boxed{25\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{40\text{mA}} + \boxed{60\text{mA}} + \boxed{60\text{mA}} + \boxed{65\text{mA}} + \boxed{65\text{mA}} \\
 & \text{Master station} \quad \text{Station a)} \quad \text{Station b)} \quad \text{Station c)} \quad \text{Station d)} \quad \text{Station e)} \quad \text{Station f)} \quad \text{Station g)} \quad \text{Station h)} \\
 & = \boxed{435\text{mA}} = \boxed{0.435\text{A}} \leq \boxed{2\text{A}}
 \end{aligned}$$

Total current consumption in the dedicated power supply 2

$$\begin{aligned}
 & \boxed{100\text{mA}} + \boxed{100\text{mA}} + \boxed{45\text{mA}} + \boxed{45\text{mA}} = \boxed{290\text{mA}} = \boxed{0.29\text{A}} \leq \boxed{2\text{A}} \\
 & \text{Station i)} \quad \text{Station j)} \quad \text{Station k)} \quad \text{Station l)}
 \end{aligned}$$

2) Voltage drop calculation

Voltage drop in the dedicated power supply 1

$$\boxed{(67\text{m}(219'9'') + \text{Constant:}11)} \times \boxed{\text{Constant:} 0.06} \times \boxed{0.435\text{A}} = \boxed{2.0358\text{V}} \leq \boxed{3.6\text{V}}$$

Maximum distance: From the dedicated power supply to the furthest station = Station h)

$$\begin{aligned}
 & \boxed{0.5\text{m}(1'7'')} + \boxed{4\text{m}(13'1'')} + \boxed{50\text{m}(164'0'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} \\
 & \quad \quad \quad + \boxed{3\text{m}(9'10'')} + \boxed{0.5\text{m}(1'7'')} = \boxed{67\text{m}(219'9'')}
 \end{aligned}$$

Voltage drop in the dedicated power supply 2

$$\boxed{(88.5\text{m}(290'4'') + \text{Constant:}11)} \times \boxed{\text{Constant:} 0.06} \times \boxed{0.29\text{A}} = \boxed{1.7313\text{V}} \leq \boxed{3.6\text{V}}$$

Maximum distance: From the dedicated power supply to the furthest station = Station l)

$$\begin{aligned}
 & \boxed{1\text{m}(3'3'')} + \boxed{75\text{m}(246'0'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{3\text{m}(9'10'')} + \boxed{0.5\text{m}(1'7'')} \\
 & \quad \quad \quad = \boxed{88.5\text{m}(290'4'')}
 \end{aligned}$$

- 3) Confirmation related to the minimum operating voltage (20.4V DC) of the module
Dedicated power supply 1: $24V - 2.0358V = 21.9642V \geq 20.4V$
Dedicated power supply 2: $24V - 1.7313V = 22.2687V \geq 20.4V$

From 1), 2) and 3) above, the system can be supported using two dedicated power supplies with regard to both the current and voltage restrictions.

MEMO

Warranty

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company. However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

- 1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
- 2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
 - a) Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
 - b) Failure caused by unapproved modifications, etc., to the product by the user.
 - c) When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
 - d) Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
 - e) Relay failure or output contact failure caused by usage beyond the specified Life of contact (cycles).
 - f) Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
 - g) Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
 - h) Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

- 1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
- 2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user or third person by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

- 1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.
- 2) The Mitsubishi programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or Public service purposes shall be excluded from the programmable logic controller applications. In addition, applications in which human life or property that could be greatly affected, such as in aircraft, medical applications, incineration and fuel devices, manned transportation, equipment for recreation and amusement, and safety devices, shall also be excluded from the programmable logic controller range of applications. However, in certain cases, some applications may be possible, providing the user consults their local Mitsubishi representative outlining the special requirements of the project, and providing that all parties concerned agree to the special circumstances, solely at the users discretion.

USER'S MANUAL (Detailed Volume)

CC-Link/LT: Power Adapter • Dedicated Power Supply



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HIMEJI WORKS: 840, CHIYODA CHO, HIMEJI, JAPAN

MODEL	CL1PAD1-U-SY-E
MODEL CODE	09R712